FEED THE FUTURE
The U.S. Government's Global Hunger & Food Security Initiative

Feed the Future Mozambique Improved Seeds for Better Agriculture (SEMEAR)
Agreement No: AID-BFS-IO-17-00005

FY2020 5th Year of Project Implementation and Final Project Report

Annual Report and Final Report: October 2019 - September 2020 and September 2015 – October 2020

October 2020

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Annual Report for FY20: October 2019 – September 2020 and Final Project Report October 2015 – September 2020

I. Project Information

Project Duration: 6 years **Date:** October 2015 – September 2021

Life of project funding: Total project budget: US$13,346,185

Geographic Focus: Nampula Province (Angoche, Malema, Meconta, Mogovolas Monapo, Rapale, and Ribaué districts), Zambézia Province (Alto Molocué, Gurué, and Mocuba districts), Manica Province (Barué, Macate, Manica, and Sussundenga districts), and Tete Province (Angónia, Macanga, and Tsangano districts).

Project Objectives

1. Increase the production and supply of breeder, pre-basic, basic, and certified seeds of common bean, cowpea, groundnut, pigeon pea, sesame, and soybean in the major Feed the Future Zones of Influence (FtF ZOI) and strengthen the national seed systems.
2. Scale-up and enhance the adoption of improved varieties and best management practices in the FtF ZOI using participatory approaches.
3. Enhance national policy dialogue on seed and fertilizer supply.

Table of Contents

I. Project Information 1
II. Acronyms and Abbreviations 3
III. Contributors and Acknowledgements 0
IV. Executive Summary 1
1. Project Background 3
2. Project Performance during fourth quarter of FY20 and over the project duration FY15 to FY20 5
2.1 Component 1: Increase the production and supply of breeder, pre-basic, basic, and certified seed in the major FtF ZOI and strengthen the national seed systems 5
2.1.1 Progress on breeders/pre-basic and basic seed production 5
2.1.2. Progress on certified seed production 12
2.1.3. Seed Distribution and Sales 19
2.1.4. Seed Enterprise Development 22
2.1.5 SEMEAR's Contribution to the National Seed System 23
2.2. Component 2: Promote and Scale-up the Adoption of Best Crop Management Practices in the FtF ZOI using Participatory Approaches 25
2.2.1. On-farm demonstrations 25
2.2.2. Training and scaling up adoption 27
2.2.3. Field days, exchange visits, and meetings 28
2.2.4 Key Results of SEMEAR End-line study in relation to the mid-term and baseline studies 30
2.2.5. Gender issues in SEMEAR implementation 33
2.2.6. Environmental Monitoring and Mitigation Plan (EMMP) compliance 37
3. Communications and Farmers' Outreach 38
4. Project Performance Indicators 43
5. Major Implementation Issues 50
6. Lessons Learned 51
7. Collaboration with Other Donor Projects 52
8. Key Activities Planned for FY 21 (SEMEAR Extension First Quarter) 53
9. Evaluation/Assessment Update 55
10. Administrative Update 55
11. Financial Information 56
12. Success Story 57

II. Acronyms and Abbreviations

APROSE	Associação pra a Promoção do Sector de Sementes (Associations for the Promotion of the Seed Sector)
COPAZA	Cooperativa de Produtores da Alta-Zambézia (Farmers Cooperative for High Zambézia)
CIAT	Centro Internacional de Agricultura Tropical (International Center for Tropical Agriculture)
CBO	Community based Organization
DINAS	Direcção Nacional de Agricultura e Siviculta (National Directorate for Agriculture and Forestry)
DPASA	Direcção Provincial de Agricultura e Segurança Alimentar (Provincial Diretorate for Agriculture and Food Security)
DUAT	Direito de Uso e Aproveitamento de Terras (Land Rights / Title)
EMMP	Environmental Monitoring and Mitigation Plan
FAs	Farmers' Associations
FAO	Food and Agriculture Organization of the United Nations
FNDS	Fundo Nacional de Desenvolvimento Sustentável (National Fund for Sustainable Development)
FtF ZOI	Feed-the-Future Zone of Influence
FtF -InovA	Feed the Future Innovations for Agriculture Activity
FtF STP	Feed the Future Seed Trade project
ICRISAT	International Centre for Research in the Semi-Arid Tropics
iDE	International Development Interprises
IIAM	Instituto de Investigação Agrária de Moçambique (Mozambique Agriculture Research Institute)
IITA	International Institute of Tropical Agriculture
MASA	Ministério da Agricultura e Segurança Alimentar (Ministry of Agriculture and Food Security)
PAN	Posto Agronómico de Nampula (Nampula Agronomic Post)
PERSUAP	Pesticide Evaluation Report and Safer Use Action Plan
QDS	Quality Declared Seeds
SBS	Sociedade de Beneficiamento de Sementes (Seed Beneficiary Society)
SDAE	Serviço Distrital de Actividades Económicas (Districtal Economic Activities Service)
SPEED +	Supporting the Policy Environment for Economic Development Plus
SUSTENTA	Projecto de Gestão Integrada de Agricultura e Recursos Naturais (Project for Integrated Management of Agriculture and Natural Resources)
USAID	United States Agency for International Development
USEBA	Unidade de Semente Básica (Basic Seed Unit)
USEPA	United States Environmental Protection Agency

III. Contributors and Acknowledgements

Contributors

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Acknowledgements

We would like to extend our acknowledgement to project technicians who tirelessly continue to devote efforts at creating awareness about the benefits of improved varieties, best management practices and produced EGS that were supplied to seed producers for multiplication into certified seeds. These efforts led to the increased production and supply of good quality seeds that were distributed to farmers and other stakeholders in the Feed the Future ZOI and across the country at large. Our gratitude to those who directly or indirectly contributed to the achievement of the mission of developing resilient farming systems that play a major role in feeding the country and contribute to economic growth.

Thank you very much!

Carlos Malita

Nampula, October 2020

IV. Executive Summary

In the last five years, SEMEAR used public-private partnership approaches to address the challenge of limited access to good quality seeds of improved varieties, low private sector participation in the legume seed sector and associated inputs delivery systems, poor planning, coordination and linkages among actors. The project capitalized on partnerships with private sector seed and agro-input companies, civil society (farmers' associations, community-based organizations), and public agencies to improve the legume seed sector.

In FY20, SEMEAR produced 9.15 tons of breeder/pre-basic seed and 81.6 tons of basic seeds of common bean, cowpea, groundnuts, pigeon pea, sesame and soybean, constituting 90.8 tons of early generation seeds (EGS). The basic seed will be able to plant 2,730 ha for certified seeds during the 2020/2021 cropping season. In the last five year, the project produced 71 tons of breeder/pre-basic seed and 502 tons of basic seed across the six crops adding to 573 tons of EGS. SEMEAR supported partners including seed companies, individual seed producers, farmers' associations and NGOs to produce certified seeds through the supply of basic seeds, training on seed production and facilitation of seed field inspection by the Seed Inspection Unit (SIU). In FY 20, 19.6 tons of basic seed was sold to partners mostly seed companies who produced 778 tons of certified seed, and this quantity of seeds will cover 64,712 ha for grain production during the 2020/2021 cropping season. In the last four years, SEMEAR sold 97.66 tons of basic seed with soybean accounting for 58% followed by common bean (20%). Other partners who also benefitted from SEMEAR capacity development services including training, demonstrations and other activities but did not purchase basic seed directly from the project in the FY20 season, produced 1,196 tons of certified and Quality Declared Seeds (QDS) which can cover 47,819 ha ha for grain production in the next season. The sources of seeds for these partners include seeds purchased from seed companies, their own-saved seeds, from friends and relatives or seed distributed by other donor-funded projects. Thus, SEMEAR assisted partners to produce a total of 1,974 tons of certified or QDS in FY20 which can plant 112,531 ha for grain in FY21. In total, partners produced 7,459 tons of certified and QDS during the project duration, and 54% of this was soybean because of the relatively high seed demand.

Revenue from seed sales in FY20 wass 2,079,600 MZN ($32,000). In the last four years, SEMEAR sold 13,379,600 MZN of basic seed to partners, but unfortunately, 4,413,717 MZN representing 33% has not been paid yet. Default on payment for basic seed is a major challenge because as a project, it is difficult to take legal action against seed companies or individuals.

In terms of technology dissemination and capacity development in the last 5 years, the project established a total of 5,787 demo plots (40% led by female farmers) on 276 ha in collaboration with partners across project locations, and conducted training sessions which reached 12,370 people (43% women) including farmers and extension agents. The number of women participating in training activities increased over the period from 39% in FY16, 40% in FY17, 44% in FY18 reaching 49% in FY19 and FY20. Over 405 field days and field visits were organized during the project implementation period to promote improved technologies with the participation of 13,652 stakeholders (43% women). The project made efforts to schedule training sessions at times convenient for women and increased the number of postharvest management and processing sessions which encouraged women participation.

Over the project duration, SEMEAR established 114 partnerships with private sector companies, community organizations and public agencies which allowed the project to reach 115,206 households and directly benefitted 366,591 individuals, exceeding the five-year target by 22%. The project reached over 309,558 farmers including 112,675 women who applied improved technologies on 440,743 ha of land in the project locations, representing 10% above the project target. Forty-one percent of this area was under improved varieties, whereas 59% was under improved crop management practices. Soybean occupied the largest area (27%) under improved technologies followed by pigeon pea (22%), whereas common bean (11%) and groundnut (11%) occupied the lowest area. An end-line adoption study completed in October 2020 indicated that SEMEAR activities enhanced adoption of improved varieties in the FTF ZOI and was consistent with the mid-term adoption study results. Adoption of improved common bean varieties increased from 12% at baseline to 56%, cowpea increased from 29% to 65%, groundnut from 27% to 54%, and pigeon pea from 8% to 17%. The baseline did not capture sesame producers in the project districts, so no adoption rate was estimated; however, the end-line data indicated adoption of improved sesame varieties is 61% five years later. For soybean, 84% of the farmers who cultivated the crop used improved varieties, an increase from 36% at the beginning of the project. Adoption of good agronomic practices such as early planting, using appropriate row spacing and plant population, use of inputs such as inoculant and fertilizers increased during the project duration. These practices combined with improved varieties and good quality seeds contributed to productivity increase of up to 42% on smallholder farms. The average gross margin per hectare for the crops ranged from US$179 for cowpea to US$427 for common bean but the highest gross margins were $940/ha for common bean in FY18 and $714/ha for soybean in FY19. The two crops had the highest economic returns. The end-line study also suggested a positive spillover effects of SEMEAR interventions into nearby communities outside the project domain with direct positive implication on farm income and food security.

1. Project Background

Limited access to good quality seeds of improved and high-yielding varieties, and minimal use of external inputs together with poor crop management practices have impeded the growth of the legume production sector in Mozambique and many developing countries. Climate change resulting in frequent droughts, intense floods and other weather phenomena has worsened the challenges faced by smallholder farmers. Public sector investment in early generation seed (EGS) production is very limited[1] and at the same time, the private sector is not capable of complementing public sector activities on seeds. Thus, the formal seed system is able to meet only 10% of the seed demand and the remaining 90% relies on the informal system[2] that is dominated by retained grains from previous year, grains bought, received or exchanged as gifts from relatives, friends or neighbors, and grains bought from the local market. Because of the importance of the seed sector to the growth and development of the agricultural sector in Mozambique, USAID initiated several interventions including SEMEAR to address some of the challenges facing smallholder farmers.

A consortium of four partners led by IITA and others that include IIAM, CIAT and ICRISAT implemented SEMEAR from October 2015 to 30 September 2020. The project built on the results of a previous USAID-funded activity, "Platform for Agricultural Research and Technology Innovation (PARTI)", which facilitated the release of more than 27 varieties of common bean, cowpea, groundnut, pigeon pea, and soybean. SEMEAR focused on these five legumes and sesame that form the foundation of food and nutrition security and provide income for many smallholder farmers. These legumes are also major sources of protein and income for rural households in Mozambique and are essential for soil fertility management in smallholder farming systems, where inorganic fertilizer nitrogen is not used. Sesame and soybean are also important cash crops that can significantly boost economic growth in rural communities. Based on comparative advantage, IITA focused on cowpea, sesame, and soybean; CIAT on common bean; ICRISAT on groundnut and pigeon pea; and IIAM on all six crops. The project used public-private partnership approaches to address the challenge of limited access to good quality seeds of improved varieties, low private sector participation in the legume seed sector and associated inputs delivery systems, poor planning, coordination and linkages among actors. SEMEAR capitalized on partnerships with private sector seed and agro-input companies, civil society (farmers' associations, community-based organizations), and public agencies such as the Technology Transfer Centers and the *Serviço Distrital de Actividades Económicas* (SDAE) (District Services and Economic Activities) as well

[1]AGRA and Rutgers University, 2016. Mozambique Early Generation Seed Study in Mozambique. Developed for USAID. https://www.agrilinks.org/sites/default/files/resource/files/mozambique_early_generation_seed_report.pdf
[2]INOVAGRA, 2012, a value chain analysis of the Seed Sector ECIAfrica Consulting Company ltd and Austral COWI.

as other donor-funded projects to effectively reach more beneficiary households from a business perspective.

The main goal of the project was to enhance the adoption of improved technologies, income, and food security of smallholder farmers in the Feed the Future Zone of Influence (ZOI) in Manica, Nampula, Tete and Zambézia provinces (Fig 1). Eighteen districts were targeted: Barue, Gondola, Manica, and Sussundenga in Manica Province; Angoche, Malema, Meconta, Mogovolas, Monapo, Murrupula, Rapale, and Ribaue in Nampula Province; Angonia, Macanga, and Tsangano in Tete Province; and Alto Molocue, Gurue, and Mocuba in Zambézia Province. SEMEAR activities focus on three main objectives:

- Increase the production and supply of breeder, pre-basic, basic, and certified seeds of common bean, cowpea, groundnut, pigeon pea, sesame, and soybean in the major FtF ZOI and strengthen the national seed systems;
- scale-up and enhance the adoption of improved varieties and best management practices in the FtF ZOI using participatory approaches; and
- **e**nhance national policy dialogue on seeds and fertilizer supply.

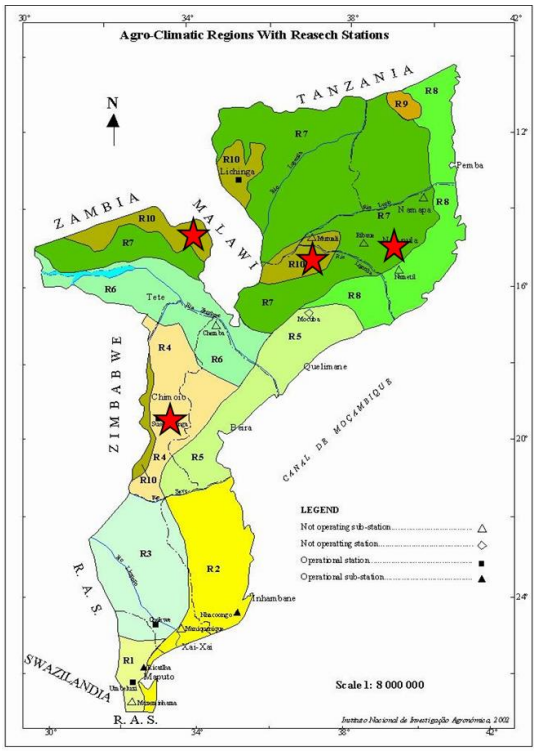

Fig 1. Map of intervention provinces and related agro-climate zones (red stars)

The key role of the consortium partners was to produce and supply breeder, pre-basic and basic seeds to produce certified and quality declared seeds (QDS) by seed companies, community-based seed producers, and other seed growers. The project encouraged farmers to buy certified seeds and inputs through training and awareness creation, identified and trained community seed producers to engage in profitable seed production enterprises, facilitated seed field inspection and certification, and linked seed producers to seed buyers. SEMEAR implementation ended on 30 September 2020, so this report highlights progress made during the fifth year FY20 and the project final report from October 2015 to September 2020.

2. Project Performance during fourth quarter of FY20 and over the project duration FY15 to FY20

During the Fourth Quarter of FY20, the project completed harvesting breeder and basic seed, threshed, cleaned, sorted and bagged seeds of all six crops. This is also the period for data collection from demonstration plots and consolidation of data gathered from partners. Farmer training sessions, field days and seed inspection are other important activities implemented to a limited extent because of the restrictions on movements and gatherings, and social distancing measures to contain the spread of the COVID-19`pandemic. The project organized a virtual project internal review meeting in July 2019 to review progress, challenges and achievements and lessons learned. Due to the COVID-19 restrictions the Annual Project Stakeholders meeting was conducted in October across the fourth provinces, Nampula, Quelimane, Tete and Chimoio to reduce the number of participants at a meeting at one time instead of the typical meetings that bring together all stakeholders at a single meeting. The final stakeholders' meeting is scheduled for 10 November in Maputo to allow the participation of Government officials. Details on progress and achievements made during FY20 and across the project duration are presented by activity as highlighted below.

2.1 Component 1: Increase the production and supply of breeder, pre-basic, basic, and certified seed in the major FtF ZOI and strengthen the national seed systems

2.1.1 Progress on breeders/pre-basic and basic seed production

Early generation seed (EGS) production over the five years began in October with land preparation across project locations and planting typically started in early December when rainfall began since the crops were grown under rainfed conditions. Soybean and groundnut fields were the first to be planted followed by pigeon pea and common bean in high rainfall ecologies. Cowpea and sesame were planted last during the second week of January through the first week of February in relatively dry ecologies. In FY20, 13.1 and 81 ha of breeder/pre-basic and basic seed fields were planted, respectively, and over the 5-year period, the project established 132 ha of breeder/pre-basic seed and 637 ha of basic seed fields. Thus, land preparation, planting, weeding, removal of off-types, manual weed control, spraying of fields to control diseases and pests, seed inspection, harvesting and post-harvest management were the main activities conducted during the seed production cycle.

Soybean

Soybean EGS fields were the first among the six crops to be planted starting around the first week of December and ended around mid-January. Harvesting and threshing were completed in the third quarter (April-June) so seed cleaning, selection, bagging and storage were activities undertaken during the fourth quarter. In FY20 1.5 tons and 33.4 tons of pre-basic and basic seeds were produced against the targets of 1.0 and 30 tons, respectively (Table 1). The pre-basic seeds produced is 50% higher than the target to allow for additional basic seed production area in the next season. The basic seed produced was 11% higher than the target. The pre-basic seed produced would cover **30 ha** basic seed fields and the basic seeds will plant **668 ha** of certified seed fields in FY21 (Table 1). Cumulatively, the project produced **195.2 tons** of soybean EGS over the project duration which represented 18% higher than the 5-year project target of 165 tons (Fig. 2). This quantity of EGS could plant **3,904 ha** of soybean field. SEMEAR achieved or exceeded its soybean EGS targets every single season during the project duration. This was encouraged by the relatively high demand for basic seed from seed companies compared with the demand for the other five crops. Varieties produced included Sana, Wamini, Wima, Zamboane and TGx 1835-10E. Germination test for Soybean and all the other crops were conducted before they are sold to partners. The germination test provides quality assurance to partners that the seeds are of good quality at the time they were taken from the seed store. The germination test also provides evidence to support SEMEAR's efforts to educate partners that crop failure in the field cannot always be attributed to poor seed quality but rather to a number of factors including how the seeds are handled from the warehouse to the farm site through transportation, soil moisture status at the time of planting and until seedling emergence, and soil compaction. The Seed Laboratory of the Seed Inspection Unit (SIU) also conducted germination tests on seed samples from all six crops before issue seed lot numbers to ease tracking of seed sources.

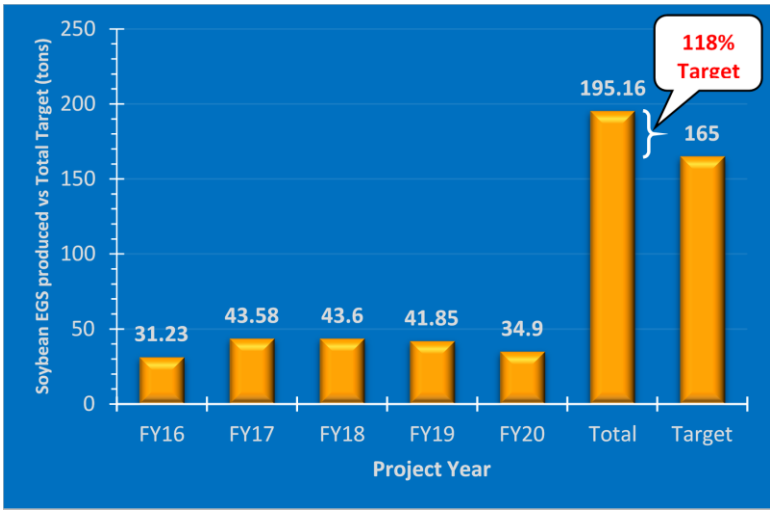

Fig. 2 Soybean EGS produced by SEMEAR over five years against the total target

Table 1: Targets and quantity of early generation seeds produced in FY19 and the estimated area of coverage for certified seed production during the 2019/2020 cropping season.

Crop	Breeder/pre-basic (t)		Basic (kg)		Estimated
	Target	Produced	Target	Produced	Coverage
Soybean	1.0	1.50	30.0	33.4	668
Cowpea	0.25	0.34	8.0	8.6	344
Sesame	0.01	0.05	1.0	2.7	900
Groundnut	4.1	3.00	37.0	20.4	291
Pigeon pea	0.05	0.06	4.3	3.4	340
Common bean	20.5	4.20	115.0	13.1	187
Total	**25.91**	**9.15**	**195.3**	**81.6**	**2,730**

Cowpea

In FY20 as in all seasons, cowpea was planted in mid-January and harvesting was completed in May. The seeds were cleaned, selected and treated to prevent insect damage, bagged and stored in the fourth quarter (July-September). The main locations for cowpea EGS production were Muriaze, Namialo and Murrupula in Nampula province; Sussundenga in Manica province; and Mutequelesse, Gurue district, Zambezia province. Off-season seed production was conducted every year from August to November under irrigation at Namarripe in Gurue district to produce quality pre-basic seed for basic seed production the following season since cowpea seeds are very susceptible to insect damage if stored for a long period. For storage, insect damage was controlled by treatment with an insecticide (*actellic*) according to the project's Environmental Monitoring and Mitigation Plan (EMMP) before bagging and storing. In FY20, **340 kg** of pre-basic and **8.6 tons** of basic seeds were produced by the project which were 8% above the year's EGS

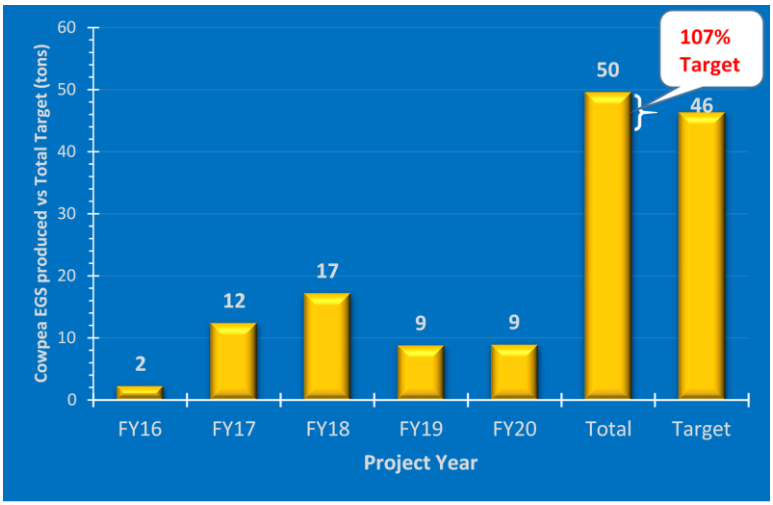

Fig. 3. Cowpea EGS produced by SEMEAR over five years against the total target

target and could plant 13.6 ha for basic seed and 344 ha for certified seed next season (Table 1). Over the last 5 years, SEMEAR produced a total of **49.6 tons** of cowpea EGS which exceeded the target (46.4 tons) by 7% (Fig. 3) and could cover a total area of **1,984 ha** for basic and certified seed. Varieties planted include IT-16, IT-18, IT 1069, IT 1263.

Sesame

Research activities on sesame lack behind the five legumes because no variety was available until last year when three varieties (Linde, Nicaragua, Rama and Zaid) were given provisional release status by the National Variety Release Committee. Sesame was planted in relatively dry agro-ecologies mainly in Nampula and Manica provinces. In FY20, **50 kg** of pre-basic seed and **2.7 tons** of basic were produced by the project (Table 1). The seeding rate of sesame is very low (3 kg/ha) so the basic seed alone can plant 900 ha of certified seed field in the next growing season. Cumulatively, the project produced 2.4 times the sesame EGS target (9.9 tons vs. 4.2 tons) (Fig. 4) due to the high seed multiplication rate and to accommodate any additional demand from partners. The 9.9 tons of EGS produced could plant about 3,300 ha of land.

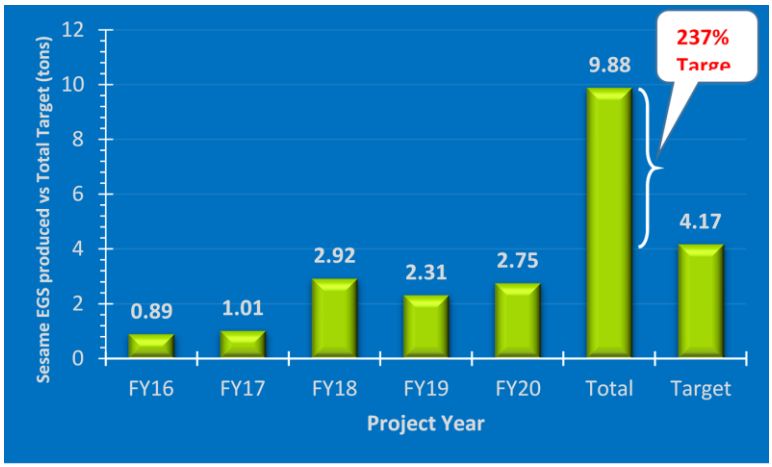

Fig. 4. Sesame EGS produced by SEMEAR over five years against the total target

Groundnut

Groundnut breeder/pre-basic seed were planted in December through mid-January of each season. During FY20, a total of 4.0 ha of breeder seed and 18.5 ha of basic seed of groundnut were planted to two groundnut varieties (Nametil and ICGV-SM 99568). The seed was lifted during the third quarter and air dried in windrows prior to stripping. Stripping (removal of pods

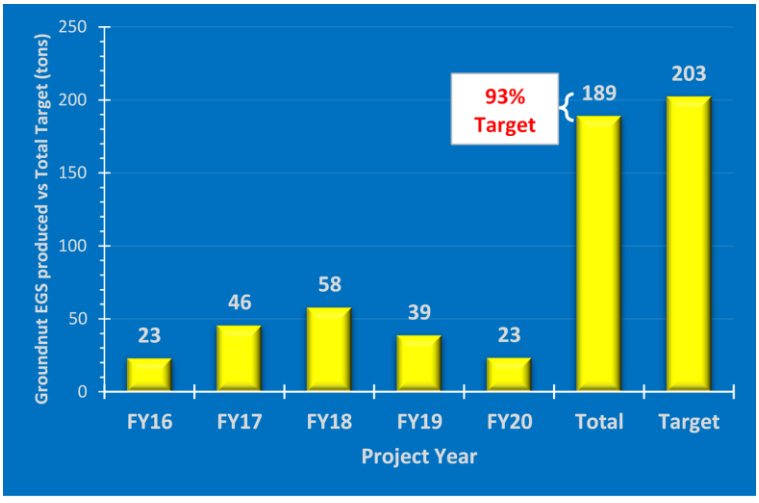

Fig. 5. Groundnut EGS produced by SEMEAR over five years against the total target

from plants/haulms) was completed in the fourth quarter. Three tons of breeder/pre-basic seeds were produced and 20.4 tons basic seed of Nametil, ICGV-SM 99568, CG 7 and Mamane varieties were produced (Table 1). The project implemented activities that achieved 73% of groundnut breeder/pre-basic seed target and 55% of the basic seed target. The under-achievement was mainly due to the reduced funding that impacted activities. This quantity of basic seed can cover 291 ha of groundnut certified seed field next season (Table 1). During the project life, 189.2 tons groundnut EGS were produced against the 202.5 tons which constitutes 93% achievement (Fig. 5). The quantity of EGS cover 2,703 ha area for basic and certified seed.

Pigeon pea

The project produced 60 kg of pigeon pea breeder seed in FY20 (Table 1) which would plant 6 ha for basic seed next season. Pigeon pea has a high multiplication rate and low seeding rate (10 kg/ha), producing as much as 2000 kg under good management. In FY20, 3.15 ha of pigeon pea basic seed was planted. The crop reached maturity in early July and produced 3.4 tons of basic seed which would cover 340 ha for certified seed production during the next growing season (Table 1). The FY20 target for breeder seed was met but 79% of basic seed target was achieved due to reduced funding. Over the project duration, 31.3 tons of pigeon pea EGS were produced which exceeded the target (19.9) by 57% (Fig. 6). The high delivery for pigeon pea EGS was in part due to the low seeding rate and high multiplication rate. The EGS produced could plant 3,130 ha of pigeon fields. The main varieties produced and promoted are ICEAP 00557, ICEAP 00554, ICEAP 00020 and ICEAP 00040.

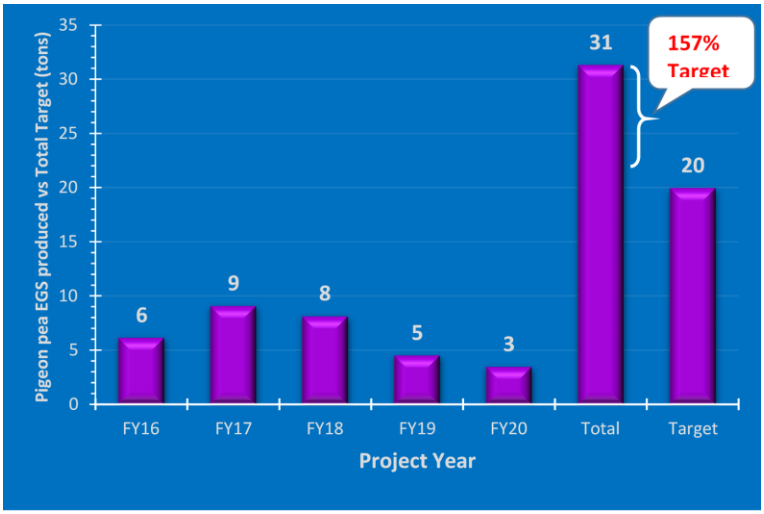

Fig. 6. Pigeon pea EGS produced by SEMEAR over five years against the total target

Common bean

Common bean EGS production was mostly concentrated in Tete province at Ntengo Umodzi Research Station with limited production in Gurue district in Zambezia province. In FY20, 5 ha were established for breeder and pre-basic seed, and 14 ha of basic seed were established resulting in the production of 4.2 tons of breeder/pre-basic seed and 13.1 tons of basic seed (Table 1). The breeder/pre-basic seed would plant 60 ha of basic seed, whereas the basic would cover 187 ha for certified seed during the 2020/2021 cropping season (Table 1). Thus, for FY20 only 13% of the 135.5 tons of the EGS target for common bean was achieved. Similarly, over the five-year period, the project produced 97.6 tons of EGS which represented 26% of the common bean target of 366.5 tons (Fig 7). Common bean EGS production faced many challenges including exceptionally high targets for which the project was unable to adjust following two unsuccessful attempts, one production cycle instead of the anticipated two production cycles each season and budget reduction. Details information of the challenges are provided on page 11. The EGS produced during the period could plant 1,394 ha of common bean fields. The varieties produced included A222, NUA 45, SUGAR 131 and CAL 143 which were the most preferred. NUA 45 for example, is biofortified with high levels of iron and zinc and recommended for FAO food security tenders.

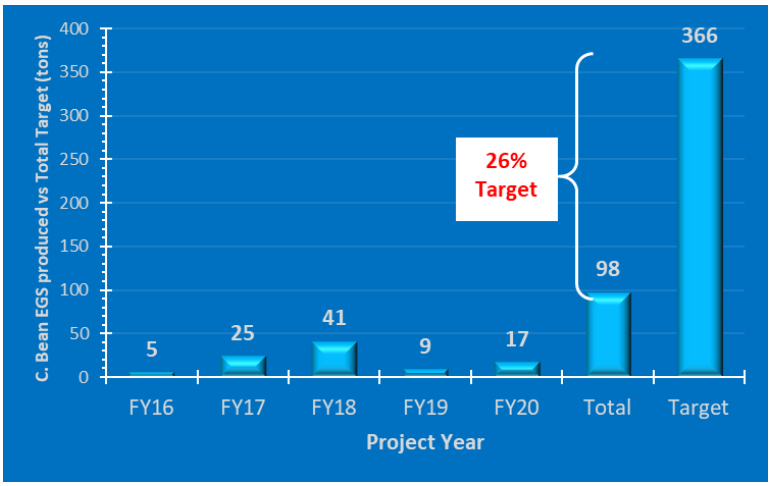

Fig. 7. Common bean EGS produced by SEMEAR over five years against the total target

Overall, 9.15 tons of breeder/pre-basic seed and 81.6 tons of basic seed were produced in FY20 cropping season against a target of 25.9 tons and 195.3 tons, respectively. These represented 35% of breeder/pre-basic target and 42% of the basic target for FY2020. Soybean, cowpea and sesame exceeded their FY2020 EGS targets, pigeon pea achieved 80% of its EGS target, groundnut achieved 57% of the EGS target whilst common bean achieved only 13 % of its target. Common bean EGS target constituted 61% of the total EGS target for the six crops so underperformance of common bean pulled down the aggregate achievement of the seed targets even if the other crops achieved their targets. The EGS targets for common bean and groundnut which are the worst performers were revised downwards to adjust for the high targets for common bean and to align with a cut in the project budget. However, the revised targets

were not accepted; thus, the poor performance of common bean and groundnut led to poor overall seed production results. The basic seeds produced would plant **2,730 ha** of certified seed fields during the 2020/2021 season (Table 1). The EGS seed produced in FY2020 was 13% lower than the quantity produced in FY2019 (Fig, 8). The basic seeds produced in the first three years of the project increased progressively: **69 tons** in FY16, **136.4 tons** in FY17, and **171.3 tons** in FY18 but declined to **105.36 tons** in FY19 and **90.8 tons** (Fig. 8) due to the exceptionally high targets and poor performance of common bean during the last two years (Fig. 7). FY18 was the most productive year because of good rainfall that was well distributed over the growing season. Combined across crops and over the project duration, SEMEAR achieved 71% of the overall EGS targets (Fig 8) due to significant challenges faced by some crops including the following.

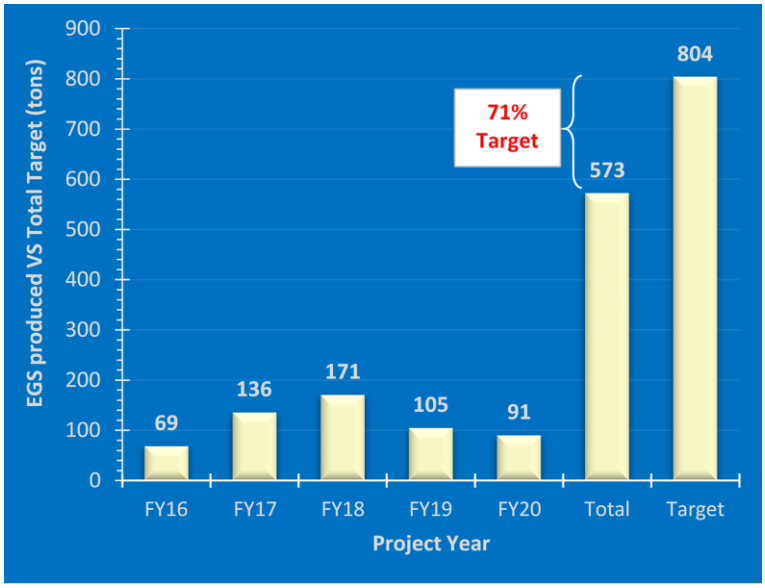

Fig. 8. EGS produced across crops by SEMEAR over five years against the total target

- Common bean EGS targets were consistently not met because of the high vulnerability of the crop to drought and excessive rainfall. The project assumed two production cycles of common bean EGS in a season with irrigation at IIAM stations but unfortunately, the facilities could not support this assumption. Hence, only one production in a season could be implemented. Thus, the resources for the rain fed and off-season productions were invested in the rain fed planting which in most cases didn't give the expected yield results. For example, in FY19, 54 ha of common bean EGS was planted; however due to torrential rains associated with Cyclone IDAI, only 9 tons of good quality seed, which is only 9% of its target was obtained (Fig 6).
- Common bean EGS targets were exceptionally high accounting for 61% of the total EGS target for the six crops. Though the other crops met or exceeded their targets (except groundnut), the huge shortfall for common bean pulled down the total EGS produced to 71% (Fig 7). The target achievement would have been be 108% if common bean was excluded from the calculations. This also reversed the increasing trend in the quantity of EGS produced over the last five years (Fig 7). The project made two unsuccessful requests in FY19 and FY20 to adjust to realistic figures.

- The SEMEAR budget cut of about 60% in FY20 compounded the challenge for common bean, groundnut and pigeon pea EGS targets.

2.1.2. Progress on certified seed production

SEMEAR played an important role in supporting the production of certified and quality declared seeds (QDS) which has increased the availability and access to and use of quality seeds by farmers. The project established partnerships with seed companies, agro-dealers, community-based seed growers and farmers' organizations within the communities and worked with them on the following: 1) sale of basic seed to partners to produce certified or QDS; 2) developed capacities of partners in seed production through in-house and on-farm training; 3) trained partners in seed enterprise development and marketing; 4) trained partners to setup demo plots and conducted joint awareness creation activities such as demonstrations to showcase and promote varieties they sell and accompanying crop management practices, fields days and exchange visits; 5) provided extension advisory services throughout the cropping season through monitoring visits for roguing, disease and pest control, early disease detection, harvesting and post-harvest management; and 6) facilitated field inspection and seed certification by linking community seed producers and staff of the Seed Inspection Unit. SEMEAR involved SDAE in all these activities particularly in establishing the demonstration plots to ensure continuity of extension support to the seed producers after SEMEAR ends. The COVID-19 pandemic in FY20 limited the scope of these activities during the third and fourth quarters because of the restrictions on movement and public gatherings, and the social distancing measures put in place to prevent the infection and spread of the disease. Thus, activities in the fourth quarter of FY20 that typically focus on harvesting, threshing, seed cleaning and bagging of seeds were mainly conducted through radio broadcast. Over the last five years, SEMEAR supported over 15 seed companies and agro-dealers, more than 165 community-based seed growers including individuals and farmers' associations to produce certified and QDS. Some of the private seed companies include Phoenix Seed Ltd, Oruwera Seeds Lda, Emilia Comercial, Klein Karoo, Sementes Nzara Yapera, Morais Comercial, Companhia do Zembe, Agri-Insumos, JNB, Matuel comercial, AGRICON; agro-dealers including Agro Sikhadzakhoka, IKURU, Dreamers Group, *Cooperativa de Produtores da Alta Zambézia* (COPAZA); and NGOs and projects such as Technoserve, SNV, iDE, SUSTENTA, OLIPA ODDES and Solidaridad.

In terms of farmers' associations, the following are examples of some the associations SEMEAR supported with seed sales, capacity and skill development, extension services, fostered linkages and facilitated seed inspection and certification: Associação Tilimbique, Associação Chiguirizano,

Associação Mwai Wathu, Associação Fonte Boa in Tete province; Associação Nova familia, Associação Wiwanana, Associação Namige, Associação Asmuc, Associação Comacoma, Associação Omananiha, Associação Yavanha Ahona, Associação Namarreco in Nampula province; Associação de Namurrequele, Associação de Namarripe, Associação de Iacote, Associação de Murrimo, Associacao Nerere None in Zambezia; and Associação Penhai Warimi, Associação Curima Cunopezda Zara, Associação Chimuana Ndimai, Associação Namutuera in Manica province. The project mobilized these associations with great enthusiam to encourage them to produced seeds of improved varieties. Seed inspection was among the many challenges faced by community seed growers since most of them are in remote locations so the project arranged with the SIU to facilitate the inspection and certification of seed fields. For this facilitation role, SEMEAR compiled the areas and GPS information of seed multiplication fields of partners every season and liaised with SIU in the provinces to schedule dates for field inspection. The inspection was organized in a way that on a single trip, the fields of up to five or more producers in that locality could be inspected. SEMEAR supported the payment of fuel (maximum 6.000 MZN ≈ $85) and per diem (Government rate of about 1700 MZN ≈ $25) for the inspectors to travel to perform field inspections. The seed producers paid the registration and inspection fees. The SIU issued certificates of inspection with Lot Numbers to the seed producers that would allow them to sell the certified seeds for a premium price. Fig. 9 shows an example of a seed producers receiving her seed inspection certificate. In FY20, SEMEAR assisted in the inspection of 288 ha seed multiplication fields belonging to partners, and in the last three years the project arranged the inspection of 662 ha. The role played by SEMEAR motivates the community-based seed producers to continue seed multiplication activities, creates the necessary linkages and encourages the seed producers to arrange their own seed inspections in the future.

Fig. 9. The President of Associação de Iacote in Gurue district, Josina Nicuantia, receiving Certified Seed Certificate from IITA Senior Research Supervisor, Carlo Pedro in 2020

SEMEAR also facilitated linkages between community seed growers and seed companies to promote out grower schemes to assist community seed producers to market their seeds. Specific successful examples in FY20 include:

- Mariano Mariano, a seed producer based in Alto Molocué, Zambezia province was linked to Phoenix Seeds Ltd through a contract to multiply soybean, common bean, sesame and pigeon pea certified seeds. Mariano expects to sell 7.8 tons of soybean, 2.7 of tons sesame and 1.27 tons of common bean. With the contract with Phoenix Seed Ltd, Mariano engaged 15 other farmers to increase the area under seed multiplication, adding another 4 tons and 3.5 tons of soybean and sesame certified seeds, respectively;
- Mr. Musa Ali, a seed producer based in Monapo, Mzeripani in Nampula province was linked to Phoenix Seeds Lda and he is expecting to sell 3 tons of sesame certified seeds. Mr. Mussa was motivated to increased seed multiplication as a result of successful business he did with an Agro-dealer based in Alto Molocué;
- Mr. Sinsseque a very well-known farmer and seed producer based in Itoculo, Monapo in Nampula province sell seeds to local farmers and he was linked to IKURU and Oruwera Seed Lda. In FY20, he sold 3.0 tons of sesame, 1.0 ton of cowpea and 1.0 ton of pigeon pea.
- Mr. Jacinto Costa, a seed producer based in Mogovolas in Nampula is expecting to sell 2 tons of sesame certified seed to Phoenix Seeds Ltd as result of linkage established between the two.

The project sold 19.6 tons of basic seed to partners during the FY20 planting season which led to the production of **778 tons** of certified and QDS. The seeds produced by partners consist of 400.8 tons of soybean; 87.4 tons of cowpea, 13.6 tons of common bean, 2.4 tons of groundnuts; 163 tons of pigeon pea and 110 tons of sesame. These quantities of certified seed would plant 8,016 ha of soybean; 3,496 ha of cowpea; 199 ha of common bean; 34 ha of groundnuts; 16,300 ha of pigeon pea; and 36,667 ha of sesame grain fields summing up to **64,712 ha** during the 2020/2021 cropping

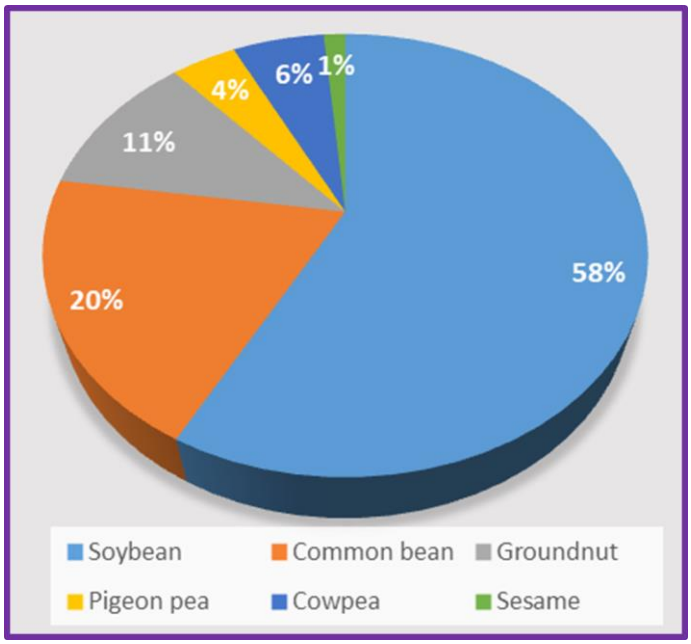

Fig. 10 The proportion of basic seed SEMEAR sold for each crop from FY17-FY20

season. Soybean is by far the crop with the highest seed purchases representing 68% and groundnut the lowest (1%) in FY20, but in terms of the area of coverage for the seeds purchased from SEMEAR, sesame accounted for 57% and pigeon pea 25% because of their low seeding rates. The seeding rate for sesame is 3 kg/ha and that for pigeon pea is 10 kg/ha. Sales of seeds produced in FY20 are on-going but seeds sales in the last four years totaled **97.66 tons** with soybean accounting for 58% followed by common bean (20%) and the lowest being sesame representing 1.4% (Fig. 10). This again indicates that the demand for soybean and common bean basic seed are higher than that for the other crops.

In addition to the basic seed supplied to partners, the project developed the capacities of certified seed producers on best crop production practices through demonstration plots established on their farms or in the communities, provided training sessions, field days, farmer exchanges programs, distributed fact sheets, aired radio programs and other activities. In FY20, these activities also assisted partners who did not purchase seeds from the project to produce **1,196 tons** of seeds which can cover **47,819 ha** for grain production next season. The sources of seeds for these farmers include seeds purchased from seed companies, their own-saved seeds, from friends and relatives or other donor-funded projects. In most cases, the seeds planted may not be basic seeds; hence the seeds produced are classified as certified 2 (C2) or QDS if the fields were not inspected and certified. Thus, the assistance provided by the project to partners contributed to the production of **1,974 tons** of certified seed and QDS during the 2019/2020 cropping season with the potential of planting **112,531 ha** next season (Table 2). When classified under various category of partners who produced the certified seeds, seed companies produced **1,128 tons** (57%), Farmers' Associations and co-operatives produced **328 tons** (17%) and individual community seed growers produced **518 tons** (26%). The quantity of seed produced (**1,974 tons**) is 72% of the FY20 certified seed target (**2,737.5 tons**) because of the low production figures for common bean (30% of the targets), groundnut (47% of the target) and pigeon pea (51% of the target). The measures to limit the spread of COVID-19 pandemic in part constrained data collection.

Table 2. Certified seeds produced by partners collaborating with SEMEAR within the FtF ZOI during the 2019/2020 growing season.

Crop	Target (t)	Quantity Produced (t)	Estimated coverage (ha) for FY19
Soybean	870.0	1038.6	20,772
Cowpea	256.0	184.1	7,364
Sesame	166.5	174.5	58,167
Common bean	700.0	208.8	2,971
Groundnut	333.0	158.0	2,257
Pigeon pea	412.0	210.0	21,000
Total	**2,737.5**	**1,974**	**112,531**

More than half of the seeds (53%) produced by SEMEAR partners in FY20 was soybean, cowpea and sesame constitute 9% each, common bean 10%, groundnut 8% and pigeon pea 11% (Table 2). However, in terms of the area of coverage, sesame has the largest share of 52% followed by pigeon pea (18%), soybean (18%), cowpea (7%), groundnut (2%) and common bean (3%); This follows a similar trend as last year.

The total certified seeds produced by SEMEAR partners over the last five years was 75% of the expected target, although it increased progressively from **479 tons** in FY16 to **1,293 tons** in FY17, **1,635 tons** in FY18, **2,077 tons** in FY19 but declined to **1974 tons** in FY20 (Fig. 11). The seed data indicate a 170% increase for the second year over the first, 26% increase in the third year compared to the second year, 27% higher for the fourth year compared to the third year and a 5% decrease in the fifth year compared to the previous year. The decline in the trend in FY20 could be in part due to the restrictions on

Fig. 11. Total certified seed produced by SEMEAR partners in the last 5 years vs. total target

movement and limited interactions with partners as a result of COVID-19 which compounded the challenges in data collection especially for common bean, groundnut and pigeon pea. Though the project made progress over the period in quantity of certified seeds produced, it overestimated the capacity of SEMEAR partners to produce the targeted quantities of certified seeds except that for soybean (Fig. 12). Again 54% of the certified seed produced by SEMEAR partners over the 5 years was soybean (Fig 12).

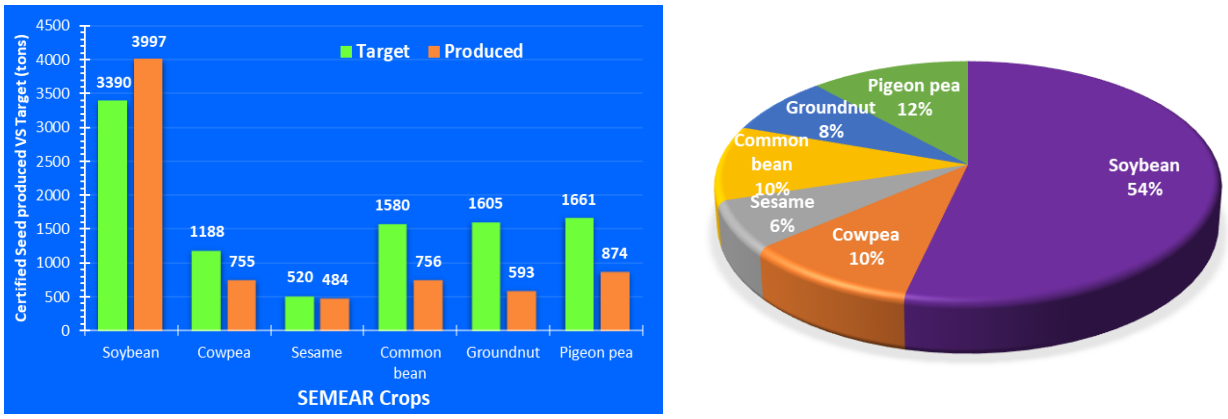

Fig. 12. Total certified seed produced by SEMEAR partners by crop vs. target in the last 5 years (left); and the proportions of seed for each crop in the last 5 years (right)

This highlights the differences between the seed system models for the six crops. There are clear distinctions between cash crops and crops grown on subsistence basis mainly for food security. For soybean, a cash crop where up to 95% of the grain is sold on the domestic market for poultry feed, substantial number of farmers get their seeds from other sources which can be easily tracked. Sesame is another crop whose seed model is gradually developing as a cash crop and getting attention from the major seed companies. Seed producers in the cash crop model have relatively large farms and produce large quantities of seed compared to those for the other crops which are grown either as food security crop or both food security and cash. Seed production in the food security crops such as cowpea are very fragmented with small seed fields and small quantities of seed produced by seed growers. This is mainly because of the relatively low demand for seed as many farmers are unwilling to buy seed; hence, the use of farmer saved seed is high as indicated in the SEMEAR End-line adoption report[3].

[3]Adoption of improved varieties and agricultural practices in Mozambique: Lessons from the implementation of the SEMEAR project. An End-line report to be submitted to USAID by SEMEAR project; 2020.

Major challenges leading to low achievement of the certified seed target

The project faced greater challenges meeting the certified seed targets since certified seed are produced by partners and not under the direct control of SEMEAR. The certified seed production figures increased progressively over the project duration as already detailed in the preceding section, although specific targets were not met. Cumulatively, the project achieved 75% of the certified seed target (Fig. 10). The low achievement could be explained by the following:

- The certified seed production figures increased over the project duration, although the crops, apart from soybean did not meet their target. Clearly, the project overestimated the capacity of SEMEAR partners to produce the targeted quantities of certified seeds. Some of the targets were not realistic, nevertheless, two requests to adjust the targets were not successful.
- The private sector and other seed producers consistently were not able to purchase the EGS produced and that also limited the quantities of certified of QDS produced
- The difficulties in getting seed production data from some partners even if the project sold basic seeds to them or provided basic seed loans to be paid at the end of the growing season. Default on seed loans was a major issue so some of the partners did not want to share their seed production data
- Perhaps the project failed in applying the necessary pressure on partners to share seed production information
- Only few seed growers produced seeds of the food security crops and in smaller quantities, perhaps due to the low seed demand for those crops
- The instability in commodity prices affected the demand for seed; and therefore, the quantity of seed produced by seed growers. For example, pigeon pea grain prices in 2017 felled by more than 85% due to the reduction in export to India; hence only few farmers produced pigeon pea in subsequent years. Seed companies scaled down production of certified seed, catering to only the available demand.

Main constraints affecting seed producers

Seed production business is constrained by various factors that limit profitability and sustainable growth as a business venture;

- **Uncertain Seed demand:** Seed sales typically begin in October through to December since many grain producers wait until it is close to planting time before procuring seeds. This creates uncertain demand which puts many seed producers in an uncertain situation. This makes it difficult to estimate effective seed demand and the quantity to produce as well as where to sell the seeds. SEMEAR supported some seed producers by linking them to seed buyers to source seeds. Seed

producers were encouraged to look for markets, especially within their communities, to sell their seeds to avoid selling them as grain.

- **High production cost:** The high cost of seed production and delivery due to poor infrastructure make seeds from the formal seed sector expensive and unaffordable to many farmers and this limits adoption and the sustainability of seed enterprises. However, the availability of community seed producers goes a long way to increase access to improved and good quality seeds since seeds from the informal sources are relatively cheaper than those purchased from formal sources. For example, certified soybean seeds from seed companies were around 120 MZN/kg ($1.70) at planting time in FY20, whereas the community-based seed producers sold at around 50 MZN ($0.70).
- **Changes in weather pattern**: Frequent drought spells affect crop development and limit yields. Apart from a few relatively large seed companies that have irrigation facilities, most of the seed producers grow their crops under rainfed conditions which make them vulnerable to climate change and climate variability, thus affecting their profitability. Although some of these crops are drought tolerant, there is a limit to the extent the plant would tolerate drought in the face of climate change. Flood is the other extreme that occur as a result of torrential rains in association weather phenomena such as cyclone cause damage to fields and infrastructure.
- **High costs of inputs**: Cost of inputs such as fertilizer and crop protection chemicals are expensive which limit the accessibility of these inputs since farmers cannot afford them, resulting in yields that are far below their potential and profit margins.
- **Unstable commodity prices**: An unexpected fall in commodity prices, sometimes as low as 85% (e.g., pigeon pea as indicated previously), discourages farmers from planting the crop; hence, seed producers find it very difficult to market their seeds.
- **Lack of Manpower**: Inadequate human capital and other resources within the SIU to effectively inspect and certify seed fields of partners is a major challenge to seed producers. The seeds of most community-based seed producers are not certified because of the limited capacity of the SIU. These prevent many community seed growers to sell to seed companies, agro-dealers, and other seed enterprises as out growers. They end up selling as QDS which are cheaper than certified seeds or in the worst-case scenario sell as grain for lack of market.

2.1.3. Seed Distribution and Sales

Early generation seed production (EGS) and distribution was a key role played by SEMEAR in partnership with the Basic Seed Unit of IIAM (USEBA) and seed producers to fill the gap between the demand and supply for EGS. Availability of EGS was one of the weakest links in the seed value chain since USEBA is the main source the seed companies relied on. Most of the seed companies were start-ups

when the project started so they lack the financial and human capital to produce basic seed. Basic seeds produced by SEMEAR were sold at subsidized prices set by USEBA which were generally about 20% lower than the market prices to encourage seed producers to buy good quality basic seed.

SEMEAR basic seed distribution over the last five years typically started in October through January. For the FY20 growing season, the project sold 19.6 tons of basic seeds to partners. Seed producers supplied with basic seed include Phoenix Seeds, AGRICON, Klein Karoo, Solidaridad, Sementes Nzara Yapera, Oruwera Seed Lda, Matuel Comercial, SBS/COPAZA, Emilia Comercial, TechnoServe and Winnua, IAV, JNB and iDe Moçambique. Over the project duration, SEMEAR supplied a total of 97.66 tons of basic seeds to partners (Fig 10). Soybean consistently had the highest basic seed demand across the years among the crops being promoted and cumulatively, accounted for 58% of the seeds supplied to partners. This is because soybean is a cash crop with relatively large farm size with an upward trend compared to the other crops so soybean certified seed demand is growing. The demand for soybean grain is high and is driven by the local poultry industry. Hence, there is ready market for grain producers, the farm gate price is attractive and generally stable relative to the other crops. About 20% of the seed sold was common bean, although common bean had the worst production results. This indicates that the crop has potential opportunity for upward trend in basic seed demand. The demand for common bean variety NUA45 has increased over the years since it is one of the preferred varieties for FAO food security tenders. It is bio-fortified with iron and zinc making it more attractive from nutrition standpoint. The project used some quantities of seeds to establish demonstration plots and other awareness creation activities. SEMEAR contributed seeds to district and provincial government programs and to partnerships and collaborative activities. SEMEAR also donated **10.6 tons** of seed (6.6 tons of cowpea and 4 tons of common beans) to the victims of cyclone IDAI for planting during the 2019/2020 season.

SEMEAR Bank Account: A special project account managed by the project manager was opened for revenue from basic seed sales. The revenue was supposed to be transferred to IIAM seed production unit to continue activities on basic seed production when the project ends. However, SEMEAR has been given a one-year cost extension; hence the project will continue to manage the account until 30 September 2021. The amount from seed sales for the 2016/2017 cropping season was 1,063,371 MZN (approx. US$ 17,432 at the time); 1,898,244.15 MZN (US$31,637) for the 2017/2018 season; MZN 3,363,305 (US$ 56,055.08) for the 2018/2019 season; and 2,079,600 MZN ($32,000) for the 2019/2020 cropping season. The seed sales for the upcoming 2020/2021 cropping season is still in progress and are not included. However, some partners have not paid for seeds taken with promises to pay later. The project has so far sold 13,379,600 MZN of basic seed to partners in the last four years. Unfortunately, 4,413717.3 MZN

representing 33% has not been paid yet; hence the project has 8,965,882.70 MZN currently in its bank account. Default on payment for basic seeds is a major problem since a project like SEMEAR would not be able to take legal action against seed companies or individuals owing the project.

Major constraints encountered in EGS production

- **Default on seed payment**: Failure of seed companies to pay for seed purchased. The project assumed that subsidizing the basic seed price will make it more attractive for private sector to take advantage of the opportunity to purchase and readily pay for the seeds, but it turned out that we were wrong. The debt situation prevented some partners from returning to the project with basic seed orders, but others still order with promises of payment.

  Measures to collect payments: The project decided that partners 1) will not be supplied with basic seed in FY20 if they did not pay 75% of their debts; and b) at least 75% of the cost for all seed orders must be paid upfront and accompanied by a formally signed promise note that payment or the remaining 25% will be paid not later than 31 January 2021.
- **Open pollinated crops**: Legumes are open pollinated crops which can easily be recycled for more than one season with little loss of vigour if the crop is managed well; hence some seed producers did not regularly invest in basic seed since the last season's crop could be used to produce other seed categories such as C2 and C3. Thus, some of the basic seed produced by SEMEAR remained unsold.

  Measures to reduce recycling: Continuous education to improve understanding that refreshing seed stock is always better since that provides assurance of quality and that diseases, seed viability and yield depression can occur with higher probability when recycled seeds are used.
- **Lack of effective demand**: Difficult in estimating effective seed demand for EGS. Certified seed producers in most cases don't send their EGS demand early enough for effective planning. They start asking for EGS when it is getting close to planting time before procuring seeds. This created uncertain demand.

  Measures for receiving timely information: Approached seed producers who depend on basic seeds on timely manner to get information on their basic seed orders in terms of crops, varieties and quantities.
- **Climate variability**: Climate change resulting in changes in the weather pattern such as frequent drought spells affected crop development and limited productivity of EGS since the crops were grown under rainfed conditions. In some years, the rains occur during the period the crop is drying or during harvesting. Under such circumstances, the seeds are discolored and could not be sold as EGS.

  Possible counter Measures: Although some of these crops are drought tolerant, there is a limit to their tolerance so supplementing rainfall with irrigation during drought spells could help. Thus, there

is the need to conduct EGS production using irrigation facilities at selected IIAM stations; for example, at Ribaué or using portable water pump especially off-season to make up for loses during the main season.

Cost-benefit Analysis Early Generation Seed Production

Production of the various classes of seed required specific standards and care to ensure genetic purity of the seeds. Breeder seed is produced by a breeder through crosses of parental lines and should have genetic purity of 100%. Pre-basic seed is a step of seed production where breeder seed is used to multiply into enough quantities of seeds for basic seed production. The breeder is responsible for the production of pre-basic seed, and production should be under very high levels of genetic control as in breeder seed. Basic seeds are produced from breeder or pre-basic seed by Institutions, authorized individuals, seed producers under conditions that ensure maintenance of genetic purity and identity. The genetic purity is lower than that for breeder seed typically 96-99.5%. The physical purity of these categories of seed should be maintained at 96-98%. Production of EGS requires high investment in equipment (irrigation), input, personnel (breeders, technicians and seasonal workers), etc. The variable production costs for EGS for the project averaged US$ 934.24. The benefit-cost ratio averaged 1.76 meaning positive return on investment that paid for the production cost and provided a margin. Common bean is the crop with the highest return on investment (benefit-cost ratio of 2.44) and cowpea has the lowest benefit-cost ratio (1.04). In terms of production cost, pigeon pea and groundnuts have the highest production costs US$ 1,029.59/ha and US$ 1,007.49/ha respectively.

2.1.4. Seed Enterprise Development

The seed business sector in Mozambique is evolving but dominated by community seed producers who are in the learning phase of the seed enterprise. Except for few established seed companies, most of the companies are start-ups and lack the skills and experience in the EGS production. In the last five years, SEMEAR provided support to seed enterprises through capacity development, sale of EGS and facilitation of linkages among actors. SEMEAR identified and trained individual farmers and farmers' associations that have the resources and entrepreneurial skills to produce seeds. The farmers supported were those who had high potential to remain viable; for example, had access to land and other resources in order not to have any impact on their food production activities, had low propensity to sell seeds as grain since they had other off-farm activities which provide additional income. Several training sessions were conducted for the seed producers on varieties, seed production, marketing, and awareness creation such as establishing demo plots, farmer-field days, and exchange visits. Training on seed production cost, profit margins, seed marketing including labelling, selling in small packs, and identifying seed markets

were conducted. Seed producers with the capacity to multiply and market certified seeds in communities include Américo Sisseque, Mussa Ali, Patricio Clemente, Mariano Mariano and Rosita Feliciano in Nampula province, Emilia Savaio and Farnela in Manica province, Agro Sikhadzakhoka, Palusso and Emilia in Tete province; Joia Muchenguete, Amélia Bitone, Albertina Manuel, Jorge Saraiva, Paulo Potocosse, Celestino Baptista and Josina Nicuantia in Zambezia; and many others who have been trained and supported since the beginning of the project.

SEMEAR sold basic seeds at subsidized prices to seed producers including seed companies, farmers' associations, individual community seed growers, and agro-dealers to support seed production. The project established functional linkages between the SIU and community seed producers for field inspection as discussed in detail in other sections of this report. The project facilitated linkages between community seed producers and seed companies to participate in out grower schemes that enabled them to market their seeds through a network of agro-dealers and retailers. For example, Olima Farm in Malema was linked to the FTF-INOVA marketing system with Hérlder Comercial, a Hub Agro-dealer based in Namiconha, Ribaué district in Nampula province. Hérlder Comercial supplies Olima Farm with certified seeds of vegetables, legumes and agro-chemicals for his inputs shop in Malema. Other examples have been discussed under certified seed production in this report.

SEMEAR developed collaborations with other projects such as SUSTENTA, iDE Mozambique, and Solidaridad to leverage on their investment to train community seed producers they work with. For SUSTENTA, the project trained nine seed growers from their Emerging Commercial Farmers *(Pequeno Agricultor Comercial Emergente* - PACE) program in Ribaué, Alto Molocué, and Mocuba on seed production and sold basic seed to them to produce sesame, cowpea and common beans certified seed.

2.1.5 SEMEAR's Contribution to the National Seed System

SEMEAR played a significant role in improving the National Seed System during the last five years by increasing the availability of basic seeds for certified seed producers, capacity development of seed producers to produce certified and QDS which allowed both female and male farmers to access good quality seed in the farming communities, and increased awareness about improved varieties and crop management practices through various communication channels. Through these activities, SEMEAR has contributed to the growth of seed business activities resulting in increased quantity of seeds transacted within the system; increased confidence in the system where a seed producer in a remote location could have his/her field inspected and issued a certificate to sell seed at premium price, and local seed producers

have earned the trust of local farmers to serve as their local seed source. These show clear evidence of potential sustainability outcomes.

Early generation seeds of legumes in the country are primarily produced by IIAM and the CGIAR centers. In a recent presentation by the Basic Seed Unit (USEBA)[4] on basic seeds of various crops produced in the last five years, seeds produced by SEMEAR accounted for 61% of the total basic seed produced for the six crops promoted by the project (Fig. 13; top). When disaggregated by seasons, SEMEAR's contributions ranged from 55% in 2019 to 69% in 2020. In terms of the individual crops, for example in 2018 which was the best production year, the contribution ranged from 41% for pigeon pea to 78% for sesame, which averaged 60% for the six crops (Fig. 13; bottom). With regards to certified seed, SEMEAR conducted a survey by talking directly to the District Directors of Agriculture in the 18 project districts and two Provincial Directors of Agriculture to assess the potential seed demand for each district and estimate the contribution of the project to seed production in the districts. Data from the survey indicated that the potential seed demand for the six crops for the 2018/2019 cropping season was 7,185 tons **(**Fig. 14**)**. The seed demand for common bean was the highest because of the high seeding rate coupled with the fact that it is double cropped during the year: main growing season and off-season under

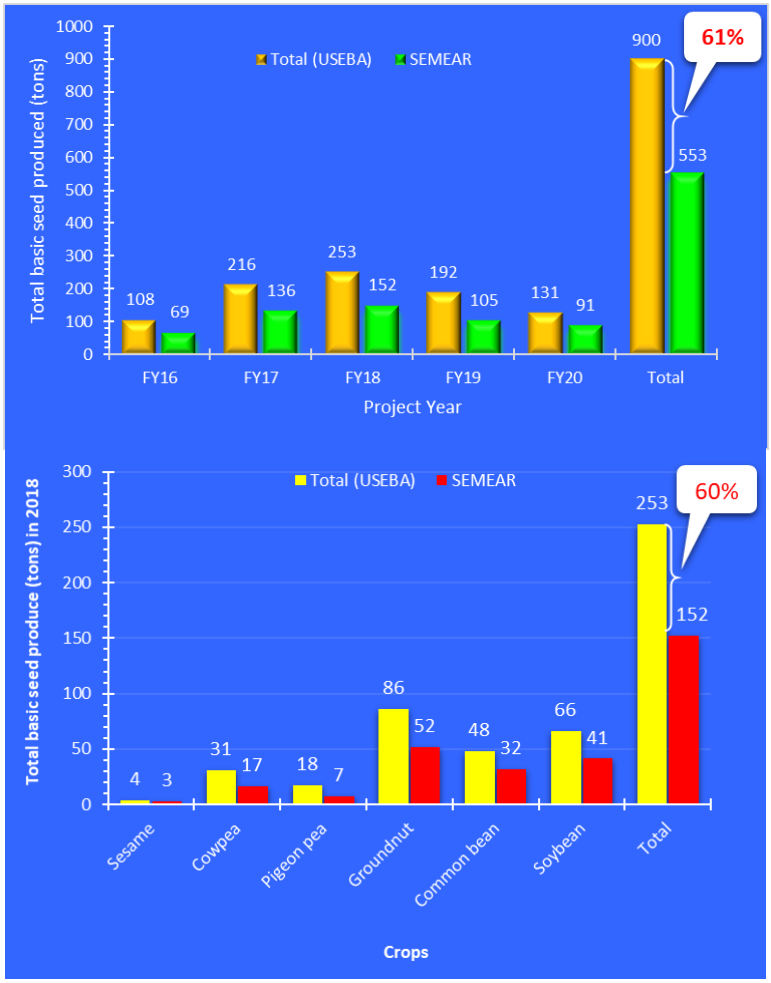

Fig. 13. Reported total basic seed of the six crops produced from 2016 to 2020 vs. SEMEAR's contribution (top); total basic seed of the six crops produced in 2018 vs. SEMEAR's contribution (bottom)

[4]Desempenho na Multiplicação de Sementes: Desafios e Lições Aprendidas, USEBA, Instituto de Investigação Agraria de Moçambique, Tee, 23 de Outubro de 2020

irrigation. The quantity of sesame seeds was the lowest because of the low seeding rate of 3 kg/ha. The seed demand for the 2018/2019 growing season suggested that the 1,635 tons of certified seeds produced by SEMEAR partners in 2018 contributed 23% of the potential seeds required for the six crops across the 18 districts assuming all the seeds were planted in the districts (Fig. 14). Sesame seeds produced by partners were 61% higher than the demand implying that most of the seeds would be planted outside the FTF ZOI. The contribution by the other crops across the 18 districts were as follows: cowpea 56%, soybean 52%, pigeon pea 20%, common bean 8%. and groundnut 6%. Assuming the same potential seed demand for the 2019/2020 cropping season, seed produced by SEMEAR partners in 2019 (2,077 tons) contributed 29% of the seed demand for the 2019/2020 season. Similarly, the seed produced in 2020 (1,974 tons) would contribute 27% of the potential seed demand for the 2020/2021 cropping season.

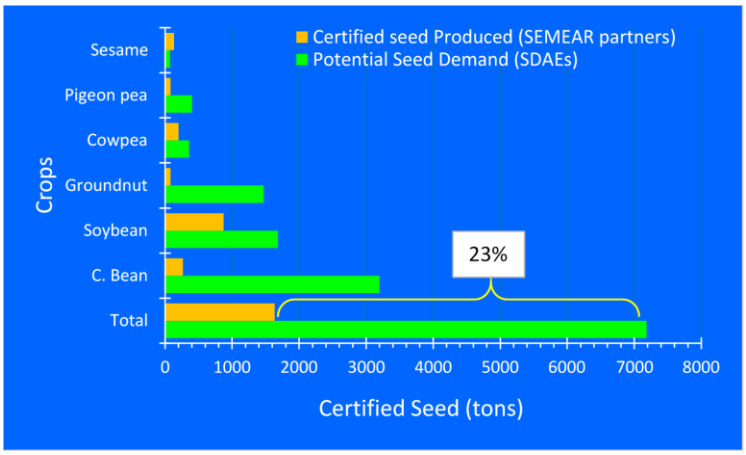

Fig. 14. Certified seed of six crops produced by SEMEAR partners in FY18 vs. the 2018 potential seed demand for the six crops in the 18 districts where the project operated

2.2. Component 2: Promote and Scale-up the Adoption of Best Crop Management Practices in the FtF ZOI using Participatory Approaches

2.2.1. On-farm demonstrations

SEMEAR partnered with farmers' associations, seed companies, agro-dealers, NGOs, the Technology Transfer Centers, Extension Service (SDAE), and other donor-funded programs notably USAID-supported projects across the FtF ZOI to scale-up and enhance adoption of varieties and crop management practices. Through these partnerships and collaborations, the project established demonstrations to create awareness and promote technologies through "learning by doing". The technologies promoted include improved varieties of all six crops and improved crop management practices in the context of the dominant cropping systems in the various locations. The technologies consist of better agronomy such as best planting time, appropriate row spacing, optimum planting density, the use of inoculant and P fertilization, legume intercrop, rotation, double-up legume, weed control, and pest and disease control.

The demonstration plots were established on the farms of male and female farmers called "Lead Farmers" selected by the farmers' associations and SEMEAR from those who volunteered to host demos. Lead farmers had farms at easily accessible locations and could conduct appropriate day to day management of the demos. The project targeted women farmers, when women were underrepresented. SEMEAR encouraged the participation of women by supporting them with small quantities of inputs such as seeds, inoculant, fertilizers and other technical assistance. The demos were used to promote and showcase technologies on farmers' fields during field days where farmers evaluated the different technologies and production options, shared experiences, and provided feedback (e.g., Fig. 15).

Fig. 15 Demonstration plot showcasing soybean varieties and importance of rotation with maize

In FY20, SEMEAR focused on market-oriented demonstration plots in partnership with seed companies and agro-dealers, farmers associations and individual seed growers and NGOs across the FtF ZOI to promote varieties as well as improved crop management practices and create demand for seeds. SEMEAR worked with SDAE in establishing and monitoring the various demonstration plots to enable them to provide the necessary support to the seed producers when the project ends. In FY20, 496 demo plots were established on 25.8 ha across crops and locations. Women farmers hosted 33% of the demo plots which is lower than that for last season (48%) since the focus was on joint demos with seed producers. This was a limitation because women are underrepresented in this sample. During the project duration, 5,787 demonstration plots were established on a total of 276 ha with partners, 40% of which were led by

women. Most of the female farmers preferred to host demonstrations on food crops like cowpea and common bean; hence, women participation was generally higher for those crops.

2.2.2. Training and scaling up adoption

SEMEAR conducted several training sessions for farmers, extension agents, technicians, seed companies, and other project partners throughout the project implementation period. Training sessions were mostly tailored to group-specific needs on subjects that include variety selection, setting up demo plots, agronomic practices in general, seed production techniques, calculation of seed production cost, good legume management practices, inoculant application, nutrition, input use, seed inspection, seed marketing and seed storage. In FY20, training in the third and fourth quarters were suspended because of the restrictions on travel and gatherings. However, SEMEAR explored the use of radio messages that were broadcast to support farmers across project locations on harvesting, post-harvest handling and marketing. Because of the pandemic, only 881 people (49% women) were trained across project sites (Table 3) instead of over 2,500 individuals trained annually. Training sessions were jointly conducted by SEMEAR teams and stakeholders such as SDAE, SBS/COPAZA, Agricon, SUSTENTA, CLUSA, SNV-OYE, BAYER, Technoserve, Dreamers Group, FAO, Solidaridad and farmers' associations. Other special training courses were also conducted during the period such as the one organized in partnership with the Soybean Innovation Lab from University of Illinois on integrated pest management (IPM) and proper application of pesticides in Nampula, Angónia and Gurué from 27 August to 12 September 2019. One hundred and one extension agents including 17 females from SDAEs and other projects or seed companies were trained on IPM and pesticide use. A follow up on this training scheduled for February 2020 was cancelled because of the pandemic. Cumulatively **12,370** people including farmers and extension agents were trained during project implementation; and 43% of the trainees were women. The project made concerted effort in encouraging women participation using several strategies which have been discussed in detail under the gender section. The number of women participating in training activities increased over the period from 39% for FY16, 40% for FY17, 44% for FY18 reaching 49% in FY19 and FY20. This trend indicates that the efforts such as scheduling training sessions at times convenient for women promoted their participation.

Student Training: During the project implementation period, 24 final year students (10 females) from local universities and polytechnics participated in a six-month internship training program that started in January and ended on 30 June. The students were involved in activities such as establishing demonstration plots, farmers training, field days, data collection for SEMEAR indicators and other

dissemination campaigns. They were also trained on field plot techniques and field experimentation. They used some of the data collected to prepare their dissertations before returning to school.

Table 3. Training sessions conducted across crops from FY16-FY20

Year	Male	Females	Total No.
FY2016	2,237	1,440	3,677
FY2017	1,856	1,258	3,114
FY2018	1,325	1,024	2,349
FY2019	1,201	1148	2,349
FY2020	452	429	881
Total	**7071**	**5,299**	**12,370**

2.2.3. Field days, exchange visits, and meetings

SEMEAR organized field days, exhibitions and field visits across project districts in collaboration with partners to promote the use of improved varieties and good management practices in the demonstration plot (e.g., Fig.16 and 17). Generally, February through April is the best period farmers and visitors could the differences among technologies options that improve productivity among smallholder farmers. The project collaborated with several organizations and individuals including farmers' associations, SDAE, NGOs, seed companies, agro-dealers and other donor funded projects such as RAMA-BC and RAMA-NC to conduct field days. District and provincial policymakers participated in the events. During this period, farmers had the opportunity to rank varieties based on their preferences, such as maturity duration, yield, and marketability of those with high market demand. Early maturing varieties are increasingly being preferred because they fit well in the current climate change scenarios, they can escape terminal drought and produce more acceptable yields than the long-duration varieties. Other field days were conducted to discuss the developments specific value chains example, bean or cowpea value chains. Participants ranked their preferred varieties based on several attributes including perceptions on taste, grain size, color, marketability, yield and general crop growth and development in the field. NUA45, a common bean variety has increasingly been the most preferred variety by woman among the common variety. The main reason for the popularity of NUA45 included: high yield for an early maturing variety, large grain size which attracts buyers' attention in the market, early maturity makes it possible for two or

three production cycles in a calendar year, and above all, nutritional education has made farmers aware of the nutritional benefits of the variety which has high contents of iron and zinc. For cowpea, where the leaves are consumed, some women preferred IT-16 because of the perceptions that lactating mothers produce more milk when the leaves of this variety is consumed. Women tend to adopt crop varieties with nutritious value compared to men who prefer for example A222 common bean variety because of the high commercial value.

Fig. 16. SEMEAR Stand at the Launch of the 2019/2020 Agricultural Season at Incise, Gurue district, Zambesia province


Fig. 17. Field day on Common bean variety demonstration plot at Muralelo, Malema district, Nampula province

SEMEAR received many visitors for field visits including US congressional delegation on a learning tour organized by Care International. The delegation visited and interacted with SEMEAR partner ACAMIR,

women farmers' association in Meconta district involved in seed productions and hosting of demonstration plots. The project organized visits every season for USAID monitoring team across project locations for field monitoring, discussion on project activities and the opportunity to interact with stakeholders such as private seed companies, farmers' groups, students and non-governmental organizations.

The restrictions on travel and gathering due to the COVID-19 pandemic limited our ability to conduct field days and exchanges in FY20. As a result, we conducted radio broadcast and live radio interactions among SEMEAR team and SDAE agents in the radio studio with farmers across project districts as indicated earlier. Therefore, only 10 field days were conducted in FY20 which were attended by 521 individuals with 53% female participants. During the project implementation period, over 405 field days and field visits were organized by SEMEAR and its partners which were attended by 13,652 stakeholders with women participants averaging 43%. Over the period, women participation increased from 42% in FY16, 41% in FY17, 47% in FY18, 44% in FY19 and 53% in FY20.

2.2.4 Key Results of SEMEAR End-line study in relation to the mid-term and baseline studies

The project conducted baseline study through informal interviews using semi-structured questionnaires and focus group discussions to capture reference point data on a set of output and outcome indicators in the FTF ZOI across Nampula, Manica, Tete and Zambézia 2015 against which the impacts of the project could be assessed. This was followed by a mid-term adoption study to assess the uptake of improved varieties, improved seeds, and other complementary technologies. The end-line study was conducted between June and September 2020 as a follow up to the baseline and mid-term adoption studies. The study was guided by four broad research questions:

- How has the seed value chain, perceptions about SEMEAR interventions, and participation in trainings evolved during the five years of project implementation?
- How do adoption rates at baseline conducted in 2015 compare with that at the end-line conducted in 2020, and what are the adoption constraints, variety preferences, and sources and modes of acquisition of good quality seeds?
- What are the impacts on yields, farm incomes, total incomes, and food security indicators?

- What are the implications or recommendation domains of the results of the SEMEAR project to future USAID funded agricultural projects and agriculture in Mozambique and other developing countries?

The end-line study indicates that access to extension services increased considerably from 5.9% at baseline to 20% with the highest increase in Manica and Tete provinces where we also observed a larger number of people who indicated they have received training and there was evidence of indirect beneficiaries near project locations. Majority of farmers preferred demonstration plots and field days over formal training in a classroom setting as the method for extension and training, regardless of gender. Female respondents cited preparation of daily chores (29%), distance to the training venues (18%) and training schedules (16%) as the main barriers to attending training sessions, whereas 27% of the males indicated distance as the major factor preventing them from attending training sessions. Similarly, significant increase in membership in farmers' associations were observed; an increase from 10% at baseline to 36%. The increases in Tete and Zambézia could partly be attributed to SEMEAR, but in Nampula both intervention and non-intervention communities had increases in association membership.

SEMEAR activities increased adoption of improved varieties in the four provinces. Between 2015 and 2020, adoption of improved varieties of common bean increased from 12% to 56%, cowpea from 29% to 65%, groundnut from 27% to 54%, and pigeon pea from 8% to 17%. The baseline did not capture sesame producers in the project districts, so no adoption rate was estimated; however, the mid-term study indicated that 58% of sesame producers used improved varieties, whilst the end-line data showed 61%. For soybean, 84% of the farmers who cultivated the crop used improved varieties, an increase from 36% at the beginning of the project and 71% at mid-term. The adoption rates for the crops at the end of the project are consistent with the mid-term figures. The mid-term rates for common bean and cowpea increased by 12% during the two and half years, those for sesame and soybean increased by 3 and 13%, respectively. In contrast, those for groundnut and pigeon pea decreased by 8 and 2%, respectively, and could be an artefact of the sampling procedure. All the varieties promoted by SEMEAR were introduced into the cropping systems more than 10 years ago. Although few of the varieties were released earlier, majority of the them were released in 2011, except for sesame which were given provisional release status in 2020. Thus, most of the varieties were known to farmers, but the major limitation was lack of access to seeds of these varieties. SEMEAR addressed this challenge through public-private partnerships, EGS production that catalyzed certified and QDS production by seed companies and community-based seed producers, and awareness creation activities. These together account for the high adoption rates observed. Soybean has the highest adoption rate because it is relatively a new crop in Mozambique; hence, farmers grow improved varieties introduced recently since there are no existing local varieties.

The most important factor that influenced variety preference for all the crops was access to seed, although the proportion of farmers who indicated this were lower for common bean and soybean; 16 and 13% respectively, compared to an average of 33% for the other four crops. The effective demand for common bean and soybean seeds are relatively high and therefore, attractive to many seed producers making them easily available and accessible than that for the other SEMEAR crops. Next to seed access for all crops in terms of variety preference is yield. For common bean, grain size and color were more important for variety selection than yield. The nutritional value was important for the food legumes particularly common bean (9.3%) and cowpea (9.7), whereas grain price was important for the cash crops; pigeon pea (9%), sesame (9.9%) and soybean (10.7%).

In terms of sources of seeds, the two main sources of seed for all six crops are farmers or relatives inside the communities and outside the community. Overall, about 42% use their own seed, and this is a significant drop from baseline where more than 75% used their own seed. Common bean and soybean registered the largest drop in the percentage of farmers using their own seeds. The survey shows that only 19% and 24% of producers use their own common bean and soybean seeds, respectively. Seed purchase was the main acquisition mode for SEMEAR crops (38.4%), followed by own production or seed recycling (33.2%) and donation (27.2%). Thus, seed purchases increased by 10.4 % compared to about 28% at baseline. In terms of gender, 38% of male respondents purchased seed, whereas 31 and 35% of female and youth, respectively, purchased seeds. In Zambézia, 34% of households in SEMEAR communities purchased seeds at end-line compared to only 12% at baseline; and in Tete province, the figure significantly increased from less than 30% at baseline to 60%. Seed purchase is very frequent for common bean and sesame where more than 60% acquired seeds through this channel and lowest for pigeon pea (22%). In-kind credit was rare and limited to a few farmers cultivating cash crops such as soybean and sesame. At baseline about 4% of farmers said they received seeds from the project, and this has increased to 12% for common bean and 24% for soybean. These are not free seed handout, but rather limited quantities of seeds contributed by the project for promotion and awareness creation activities; example, for demonstrations plots. The farmers keep the seeds they produce from the demo plots and multiply seeds of preferred varieties for planting in the next season. Adoption of good agronomic practices such as early planting, using appropriate row spacing and plant population, use of inputs such as inoculant and fertilizers increased during the project duration. Furthermore, the data suggested a spillover of these technologies into nearby communities outside SEMEAR development domain.

Greater seed availability led to area expansion of SEMEAR crops both in SEMEAR project communities and among farming households located near the project locations. For almost all crops in all four provinces, total cultivated area increased significantly. Moreover, the total cultivated area of SEMEAR crops was larger for SEMEAR communities when compared to non-intervention communities, regardless of whether they are located near or far from the project area. Furthermore, total cultivated area was larger in non-intervention communities that are near the project area relative to those located more than 10 km from the project locations, suggesting positive spillover effects of SEMEAR activities.

Results from doubly robust econometric model suggest that there are double benefits of adoption of improved seed varieties: better access to improved and good quality seeds led to area expansion. Cropped area increased by 16% due to adoption of improved varieties. Furthermore, the use of good agronomic practices combined with improved varieties and good quality seeds contributed to productivity increase of up to 42% on smallholder farms. The increase in cropped area was accompanied by enhanced crop diversification. Diets are less diversified in Nampula and Zambézia regardless of the recall period (24-hour recall, 7 days, surplus period, lean season, and normal period), which is consistent with the chronic malnutrition data in the country that indicate higher rates of stunting and wasting in these two provinces. In contrast, Tete and Manica have diversified diets perhaps due to availability of several diet options.

It is clear from the end-line report that the SEMEAR intervention has made significant contribution to the legume seed system of Mozambique. The intervention improved access to good quality seeds which has led to significant increases in the adoption of improved varieties, and associated increases in yields, incomes and food availability. These gains can only be sustained if there is continuous availability of EGS for the production of good quality seeds. Interventions like SEMEAR has demonstrated such ability and the lessons learned should inform future investment in the agricultural sector of Mozambique.

2.2.5. Gender issues in SEMEAR implementation

The project made concerted efforts to increase female participation in project activities by targeting women to host demo plots, for seed multiplication and for specific training sessions. Special female targeted training sessions and technical assistance were provided to women groups such as Associação Mão Viva de Lissava (Fig 18) and Associação de Ana Gulamanha in Mocuba, Associação de Mulheres de Namurrequele, Associação de Mulheres de Namarripe, Associação de Mulheres de Nanari, Associação Wiwanana wa Athiana, and NOSSARA Women's Association in Gurue district; Associação Entre Rios in Ato Molocue district; and Associação ACAMIR in Meconta district, Nampula province.

The time for female targeted events were discussed together with the associations and scheduled for the appropriate period to allow more women to participate. Female targeted activities focused on varieties, crop management, input use, seed production cost, record keeping, nutrition and post-harvest processing. Female farmers and female farmers' groups were supported with limited quantities of seeds and inputs such as P fertilizer and inoculant to host demo plots as Lead Farmers in their communities to increase awareness about the potentials of the new varieties and technologies, and to assist in the selection of varieties of their choice. For example, in FY19, SEMEAR provided Associação Mão Viva de Lissava in Mocuba and Associação de Mulheres de Namirequele in Gurue 50 kg each of soybean basic seed, P fertilizer and inoculant for certified seed multiplication and demo plots. They were trained on planting, inoculant application procedures, the benefits of inoculation and how to check nodulation etc. NOSARA based in Ruace is well established in soybean production and processing. The group produces soybean and processes into different soy-based food products such as soybean flour, bread, cakes, biscuits, soymilk etc. that are sold locally and across the province especially during trade fairs. SEMEAR trained them on soybean production practices, cost of production, profit margin and how to maximize returns on their investment.

Fig 18. An IITA technician (Carlos Pedro) training members of Associsacao Mao Viva de Lissava in Mocuba on seed production costs and record keeping

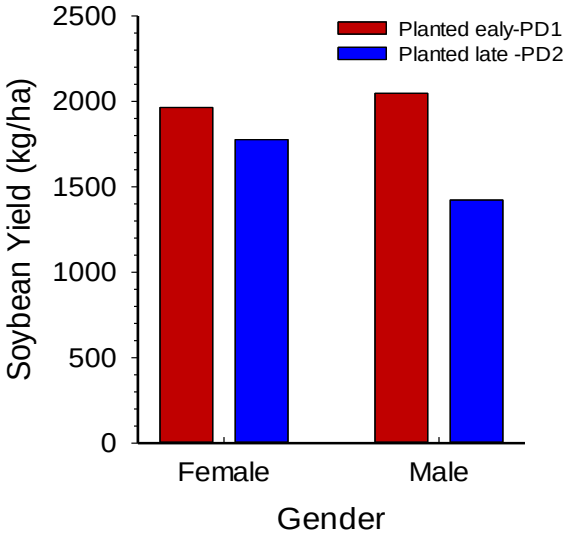

Fig. 19. Soybean yields from female and male managed demonstration plots

Data analyses from demo plot results indicated that generally, there were no significant yield differences between men and women managed plots. We observed for example that when soybean planting delayed, yields of female-managed demo plots were higher than that for males (Fig. 19). Perhaps women continued to manage crops in the field throughout the season while their male counterparts shifted

attention to the marketing of the produce towards the end of the season; hence pay little attention to crops still in the fields after harvesting started. For cowpea, yields of females were on average higher than those of males by about 50 kg/ha, possibly due to good management practices since cowpea is a major food security crop that is important to women (Fig. 20 left). Phosphorus application improves cowpea yields significantly, but generally, yields from female-managed demos did not differ from those from the male-managed plots (Fig. 20 right).

Cowpea quality traits of importance to women included seed size, color, taste and fast cooking and high yield, whereas the men overwhelmingly preferred high yields over all other traits in view of the associated potential for selling surplus production. Similarly, there were no significant gender yield gap for the common bean demonstration plots. Female farmers generally use low and fewer inputs and are less likely to switch to new varieties primarily due to affordability and to some extent lack of information on improved management. Overall, there was clear evidence that given the same resources and operating conditions, yields of female farmers were as good as male farmers.

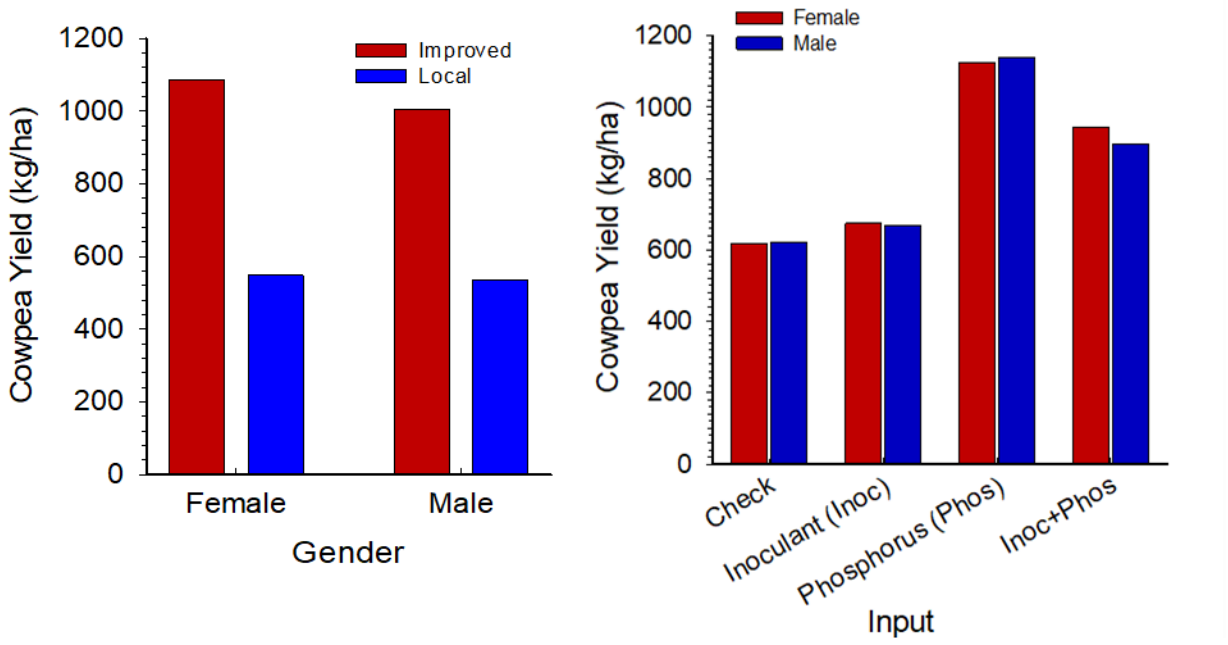

Fig. 20. Yields of improved and local cowpea varieties from female and male managed demo plots (Left); and cowpea yield responses to phosphorous fertilizer and inoculant (Right)

SEMEAR supported a group of women to collectively procure inputs in Angónia and another group of 25 females from Kaudza, Tsangano came together under the guidance of SEMEAR to purchase fertilizer in bulk and later repackaged into 10 or 25 kg to facilitate affordability among women farmers. Several

women targeted activities were also organized around common demo plots and nutrition in Angónia, Alto Molocué and other districts.

The female targeted activities contributed to increased female participation in project activities compared with the same period last year. Female participation in hosting demo plots improved from an average of 35% in FY16 to about 38% in FY17, 40% in FY18 and 48% in FY19. Market-oriented demos in partnership with seed producers was the focus in FY20; hence women representation was low (33%) given the relatively few women engage in seed production. The number of women participating in training activities also continued to increase over the years from 39% for FY16, 40% for FY17, 44% for FY18 and reached 49% in FY19 and FY20. Women participation in field days also increased from 42% in FY16, 41% in FY17, 47% in FY18, 44% in FY19 and 53% in FY20. These show great progress over the period in women involvement in project activities.

Gender Analysis in the FtF ZOI

Gender is an important component of SEMEAR implementation; the project completed a gender-based survey in 2018 for gender analysis. The objective of the study was to identify, understand and explain the gaps between male and female beneficiaries in the households and within project communities to guide project implementation in ensuring gender equity. It examined the differences between male and female using the framework recommended by the Women's Empowerment in Agriculture Index (WEAI). The study focused on legal rights and status, access to and control of resources, and decision making and power. The study found that the proportion of female-headed households ranged from 3.8% in Nampula province to 16.7 % in Manica province, and on average 5.2% of the households were female headed. Irrespective of the similarities between female and male in age and education more males (83%) in the households have access to an average of 2.39 ha of arable land, while less than 30% of females have access to an average of 1.29 ha of land. Thus, female farmers have access to 46% less lands compared to their male counterparts. The user rights land tenure arrangement which is the second most popular arrangement in the FtF ZOI is relatively common among female farmers because they are allocated as a result of marriage. These women have only user rights to lands they acquire from community chefs or family heads, and the right can be lost in the events of relocation, divorce or death of a spouse. Because males have access to larger land area, they are able to allocate relatively larger portions of their land resources to the SEMEAR crops. However, some women allocate similar area as men to cowpea and soybean, perhaps cowpea is a major food security crop and soybean is a cash crop which requires relatively lower investment making it easier for women to cultivate. Apart from land resource constraints, female farmers lack productive resources, including time, farming inputs and credit to invest adequately

on lands allocated to them. The study found that both females and males farmers explore similar sources for extension information on agricultural production and there are no differences in access between female and male farmers.

The Gender study showed that females are mostly caretakers of crop fields but less than 30% of those who manage fields have the power to make production and marketing decisions. Instead, these decisions are taken up by the household heads who are mostly males. On the other hand, most male plot managers enjoy decision-making autonomy on field operations. Customary norms are important in the decision-making processes among the households as it dominates the reasons assigned to the choice of decision makers. In the FtF ZOI, 57% of the households indicated that customs play a major role in who makes decisions surrounding livelihood and this overwhelmingly favors males. It is also important to mention that in some households (21%) men and women jointly agree on household decisions including the choice of crops to grow and marketing. It was interesting to note that the power to make decisions in the households was less tied to asset ownership or the one who has more resources suggesting that these in a way boost women empowerment. There is evidence that the decision-making powers of females increased when higher proportions of males are engaged in off-farm activities. In Manica 46% of females make household decision which correlates with the higher proportion (22%) of males engaged in off-farm wage earnings.

2.2.6. Environmental Monitoring and Mitigation Plan (EMMP) compliance

SEMEAR field activities were implemented in accordance with the environmental monitoring and mitigation plan (EMMP) to avoid pollution, wastage and harm to staff, partners and other living organisms. Land preparation and planting were done at the right time along the contour to control erosion; hence minimize sediment movement downhill to water bodies. Where necessary, ridges were constructed to reduce the speed of surface water movement and to ensure enhanced infiltration. Since SEMEAR promoted legumes which is capable of fixing nitrogen from the atmosphere into the soil, little or no fertilizer nitrogen was used. However, the project promoted the use of the right quantity (40 kg/ha) of P fertilizer. This quantity is low and less probable to leave high residual P in the soil that would be carried away in run-off.

Staff and partners were trained on chemical identification and proper application procedures that prevent contamination of the environment or poisoning of humans and animals. When using any chemical, protective gear such as gumboots, overalls, masks, gloves and helmets were mandatory and using the

right concentration and limited frequency of pesticide use. Only staff and farmers trained in safe use and handling of pesticides were recommended to conduct spraying activities. The project emphasized IPM including the use of rotation and intercropping systems to reduce weeds and pest infestations. All pesticide products procured are registered and approved by USEPA as indicated in the 2017 USAID Mozambique PERSUAP. The pesticides procured for use are also approved by the Mozambican authorities. The insecticides used include Cypermethrin and Imidacloprid to control aphids, thrips, pod borers, army worms, and other field insects. The project used Primophos-methyl for seed treatment in storage to prevent weevil attack especially in cowpea. For fungicides, the chemicals used are Triazoles, Strobilurin and Difenoconazole to control fungi and bacterial diseases. Empty pesticide containers were rinsed several times with water and the water added to the spraying tank to complete the spraying activity. The washed containers are then kept in a specially prepared wooden box and locked for later delivery to a licensed disposal contractor. Some precautionary measures taken included avoiding the application of pesticides under windy conditions to prevent pesticide drift and procuring only the quantities of the required pesticides for immediate use to avoid keeping chemicals for long periods.

3. Communications and Farmers' Outreach

SEMEAR embarked on massive communication activities to create awareness about the technologies the project promoted, increased the visibility and impacts of the project by developing appropriate packages of information on varieties and good crop production practices for dissemination to farmers. The project engaged beneficiary farmers and households on demonstration plots, field days, farmer exchange visits, and agricultural fairs where seed, chemicals and other inputs were exhibited. Bulletins, facts sheets, newspaper articles and other extension and promotional materials were developed and distributed to farmers and stakeholders. In addition, radio programs on varieties, crop management practices and nutrition were developed and broadcasted on community radio stations across project districts and TV programs were aired on national and local TV stations. Some of the important communication and outreach activities implemented during the period include the following:

Increased visibility of the project

- *Visibility on USAID Media Platforms* - project strengthened its engagement with USAID Development and Communication Outreach (DOC) team, which significantly increased the visibility of the project among a broader USAID audience. A Live Streaming program was uploaded on USAID Facebook on 12th June 2020 during the commemorations of the "World Food day" - one SEMEAR beneficiary (Mariano Alberto direct from Alto Molocué district) together with the Project Manager (Carlos Malita) were guests on the live streaming, and shared information on the results and testimonies on the impacts of the project. The live streaming was 30 minutes long and was lively

viewed by 539 internauts (Fig. 21); SEMEAR reached international audiences through two success stories shared on Agrilinks platform during the Agrilinks Gender Special Week and one of these stories has been shared on USAID's Facebook page. Two success stories staring project beneficiaries are almost ready for publication on Agrilinks and other appropriate USAID media platforms;

Figure 21 Promotion of USAID Mozambique FB page live streaming

- *Local Visibility* – Newspaper articles were published in "Jornal Notícias", "Diário de Moçambique", "Visão", EXAME, and "O Jornal Domingo" during the project period. Six articles about SEMEAR were published in these newspapers. The Economic Magazine "Visão" has a circulation of 10,000 printed copies and covers an external electronic audience of more than 48,000 readers across Mozambique and Portugal. The project had a full-page coverage in EXAME with an article about project activities and interviews with the project manager and an IIAM agronomist (Engº Marques Donça);
- *Weekly bullets* – The project prepared weekly bullets on activity implementation, project news or short stories for submission to USAID
- *Project 4 years Results* – the project developed an infographic containing information on results and impacts of the project from 2015 to 2019 that was distributed to project implementing partners and collaborators (Fig. 22).

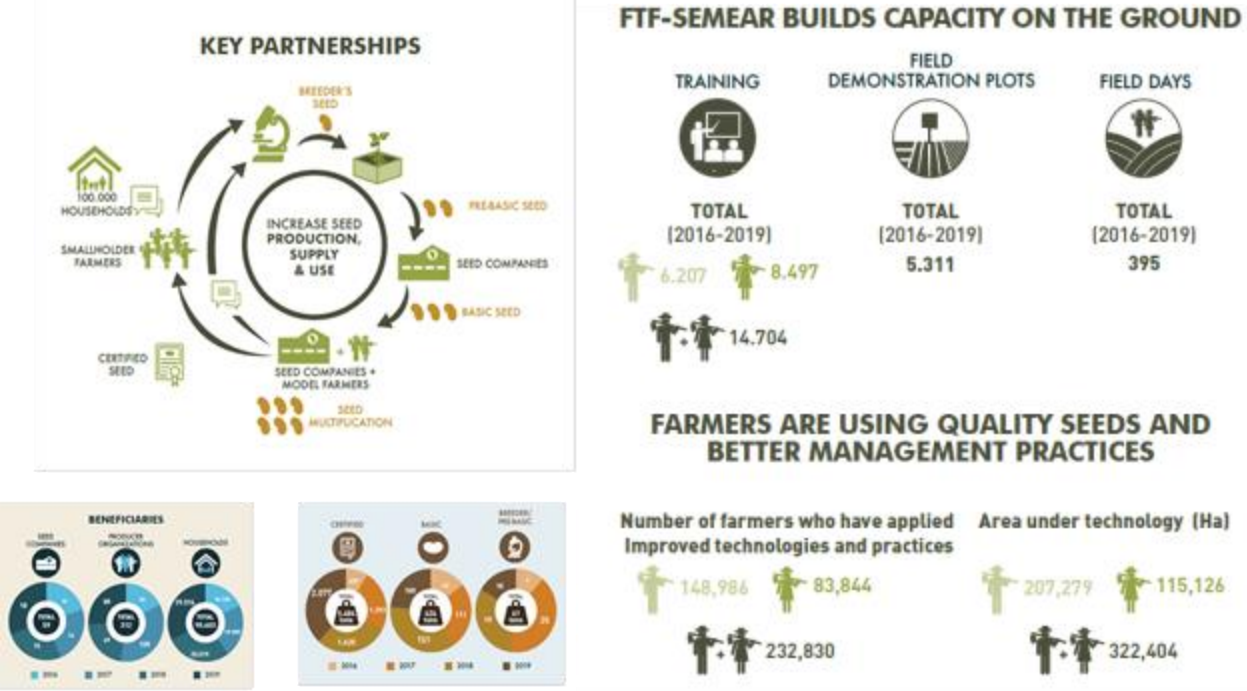

Fig. 22 Some of the infographics produced

Field visits, Agriculture Input Promotion Fairs, Field days and meetings

- *Agriculture Inputs Promotion Fairs* - The project participated in various agricultural inputs fairs to promote seeds of various varieties and share information with participants including dissemination of certified seeds by partners and seed producers, products available on the markets and inputs distribution models. During these fairs farmers acquire seeds, chemicals and other products. Participants were briefed on the advantages of using improved seeds and technologies, the project exhibited seeds of the crops promoted by the project (Fig. 16).
- *Community Radio Programs*– the project developed and broadcasted several radio programs during the period; the most recent was conducted in response to COVID-19 pandemic due to the restrictions on movement and gatherings. Radio messages on harvesting, post-harvest management and marketing were broadcasted on 24 Community Radios in Manica, Nampula, Tete and Zambézia provinces, covering 9 districts in the first phase and 15 other districts in the second phase (Fig. 23). Apart from the messages, Community Radio aired live and interactive program "*Aló Produtor*", where a local "Champion" farmer and one extension officer went to the radio studio and interacted with the audiences, answered questions and shared experiences. The programs also provided useful information on preventive measures for COVID-19. The Institute of Socio Communication (ICS) and National Community Radios Forum (FORCOM) estimated the audience as indicated in Table

4 based on previous surveys. The Radio programs succeeded in bringing discussions on best crop production practices, harvest and post-harvest techniques, importance of using improved seeds to increase yield and incomes in the communities. The farmers participated and requested the programs should be repeated regularly.

Fig 23. SEMEAR Team and guests during '*Alô Produtor'* Live radio programs in Macanga, Meconta, and Murrupula districts.

Table 4: Community Radio audience provided by ICS and FORCOM

Community Radio/district	Coverage
Sussendenga	160,121
Gandua/Gondola	47,836
Angónia	330,378
Licungo/Mocuba	300,628
Alto Molocué	272,482
Gurué	297,935
Namialo/Meconta	154,843
Ribaué	186,250
Murrupula	19,590
Monapo	20,000
Mogovolas	24,000
Angoche	30,000
Barué	60,000
Macanga	40,000
TOTAL ICS	**1,944,063**

- *Media messages:* In collaboration with CLUSA Multimedia project, SEMEAR developed various on-demand (voice and script) messages launched in the Vodacom Platform 321 (24 messages about groundnut and 16 about pigeon pea) which covered an audience of about 2,903 people with the highest number of users accessing messages about land preparation (461) and planting (431).

Increase access to information about best crop management practices

- *Seed Production manual and Crop Suitability calendars* – the project developed and printed seed manual (more than 1,000 copies) and the crop suitability calendar (more than 500 copies). The seed manual is an important tool providing technical information on seed production, varieties, inspection, certification and marketing techniques while the crop calendar presents information on suitability of crops to the various agro-ecologies in the country with emphasis on the crops promoted by the project and project locations. These were distributed massively to farmers, partners, SDAE, Provincial Services for Economic Activities (SPAE) and other stakeholders (Fig. 24). Paula Pimentel, SEMEAR AOR presenting to the Provincial Director of Agriculture in Manica province one Crop Suitability Calendar during her supervision visit to the project locations in Manica in early March 2020).
- Developed and distributed over 4,000 fact sheets and newsletters in both Portuguese and English for various audiences. Developed and printed handouts for farmers: 200 copies of simple flyers about cowpea and groundnut seed characteristics were distributed; 400 copies of protocol for establishing demo plots were distributed to farmers.
- The project developed its website (www.semearmoz.com) where project information and photos were shared and updated regularly. The site was accessed by numerous people who contacted the project for further relevant information. To improve contact and for easy access to relevant information about improved seeds and related agricultural practices, a new website layout was developed based on user interface (UI) and user experience (UX) research and design methodologies. Some approaches applied were include user observations, think aloud protocol, semi-structured interviews, affinity walls, and heuristic evaluations.

Fig. 24 - Agriculture Calendar offered to DPAP Manica by Paula Pimentel (SEMEAR AOR)

Engagement with public sector partners

- *Improving Extension Services* – the technical information developed by the project is a "public good" and major efforts were made to be successful in this regard. The project engaged with the Ministry of Agriculture and Rural Developed (MADER) in order to have the technical contents developed by SEMEAR to be used in extension materials to help change farmer practices and increase production and productivity.

SEMEAR Website Content migration

- *Technology dissemination and demand creation* – the project engaged in partnership with the Association for the Promotion of the Seed Sector (APROSE) to expand dissemination of information on production of Early Generation Seeds (EGS) and best crop management practices. Through this partnership, the website contents of SEMEAR can be viewed through the APROSE website www.aprose.org and the link https://aprose.org/sobre-semear/#. Since the migration of SEMEAR content information into APROSE's website in March 2020, more than 1,243 users have browsed and visited the webpage, more than 417 users have visited the link with SEMEAR content (more than 33% of visitors sought information related to the SEMEAR content).

4. Project Performance Indicators

The last two seasons of the life cycle of SEMEAR was characterized by two natural disasters, two cyclones and COVID-19 pandemic, yet performance has been stable and remarkable. This shows that the approach of SEMEAR is inherently resilient and can withstand adversities.

The project established 27 partnerships by the end of FY20 that allowed SEMEAR to build capacities of 96 organizations and 903 individuals in FY20 (Table 5). For the five-year period, the number of partnerships formed increased from 14 in the first year (FY16) to 27 in the last year (FY20), and this assisted in developing the capacities of 467 organizations, including 375 farmer/community based organizations (Fig. 25 and 26). In addition to capacity building, the partnerships facilitated the production of 1,974 tons of certified seeds, estimated to cover 112,531 ha in the next growing season (Table 2). Using an average area of 0.5 ha per farm household, this quantity of seeds is expected to benefit 225,062 households.

The overall five-year results of the institutional indicators exceeded the targets (Fig. 25). Partnership targets were exceeded each year and cumulatively by 14%, indicating the ability of the project team to establish synergies with existing organizations and programs to scale-out production and capacity building activities. With regards to institutional capacity building, the project exceeded targets in three out of the five years (Fig. 26). Performance for FY20, for instance, was constrained by the COVID-19 pandemic. Nonetheless, the good performance in FY17 compensated the shortfall, ensuring that the project exceeded the overall target for institutional capacity building by 8%. Building capacities of such organizations, especially, those directly involved in seed production provides a good foundation for the development of the legume seed system.

Table 5: Capacity development by the Fourth Quarter of FY 2020

Indicator	Disaggregation	Q4		Cumulative	
		Target	Results	Target	Results
Partnerships (N)	Agric. production	0	0	25	27
Beneficiary organizations (N)	For-profit	0	0	19	33
	Producer	0	0	88	63
	Total	**0**	**0**	**107**	**96**
Individuals trained (N)	Farmers	122	0	1,700	881
	Govt. workers	25	18	100	22
	Total	**147**	**18**	**1,800**	**903**
Individual beneficiaries (N)	Farmers	0	3,541	72,750	86,089
	Govt. workers	0	18	2,250	22
	Total	**0**	**3,559**	**75,000**	**86,111**

In addition to restrictions on movement, COVID-19 preventive protocols also prohibited meetings and gatherings. This constrained the ability of the project to effectively conduct planned training activities in FY20. Hence, the project trained 903 individuals by the end of the fourth quarter representing nearly 50% of the target for the year (Table 5; Fig. 27). This notwithstanding, the total number of people trained during the five-year period was 15,607 and was 4% above the global target (Fig. 27). The good performance in FY16 and FY18 compensated the shortfall in FY20.

Also, in the fourth quarter of FY20, the project reached 3,559 individual beneficiaries making a total of 86,111 at the end of the season (Table 5). The total number of beneficiaries included individuals who received training, mostly in the first two quarters, and those who were supported to access seeds for the season. By the end of the five-year period, the project reached a total of 366,591 direct beneficiaries, about 22% above the five-year target of 300,000 (Fig. 28).

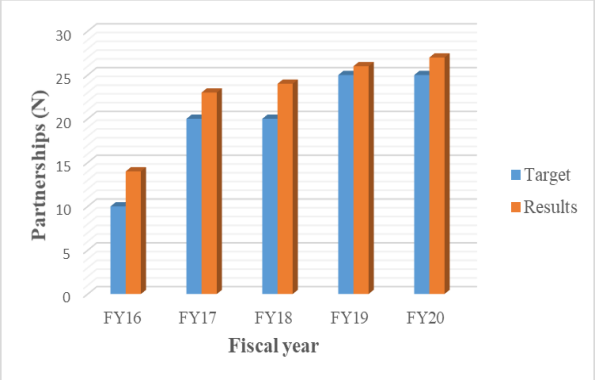

Fig. 25: Partnerships formed (FY16-FY20)

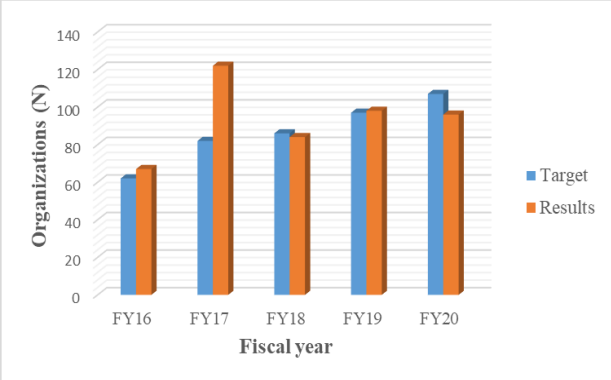

Fig. 26: Organizations strengthened (FY16-FY20)

Further review of the data in Fig. 27 and 28, show that SEMEAR was consistent in engaging female and youth farmers. Throughout the five-year period more than 30% of the project beneficiaries have consistently been female farmers. Indeed, for a specific indicator like training, about 42% of the beneficiaries were female farmers (Fig. 27). In terms of direct beneficiaries, the project reached 122,199 female farmers (about 33% of total beneficiaries) with various support in establishing field demonstrations, setting up seed businesses, and grain production (Fig. 28). Building capacities and supporting female farmers is very essential as they mostly cultivate crops like cowpea that directly impact on the food and nutrition needs of farm households. Similarly, incomes obtained from their production activities are most likely to be used for household sustenance.

Participation of youths in the project activities significantly increased when the team began targeted them. In fact, this year was very remarkable as the proportion of youths in the project activity increased to about 37% (Fig. 29). The observed results for FY20 is a balance between the fear of COVID-19 and the positive externality associated with the restrictions on movement. Initially, the panic associated with the pandemic compelled some farmers to minimize agricultural activities. The results show that there were significantly more young farmers who applied improved technologies (Table 6). The approach and technologies promoted has enabled these young farmers to engage in legume production as one of the alternatives to labor migration. This is an achievement that is worth sustaining in the future.

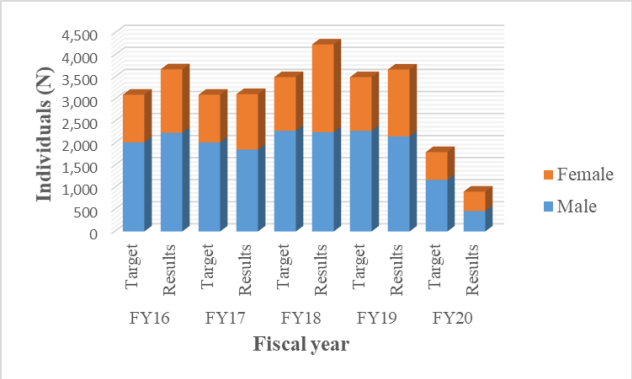

Fig 27: Gender disaggregated trainees (FY16-FY20)

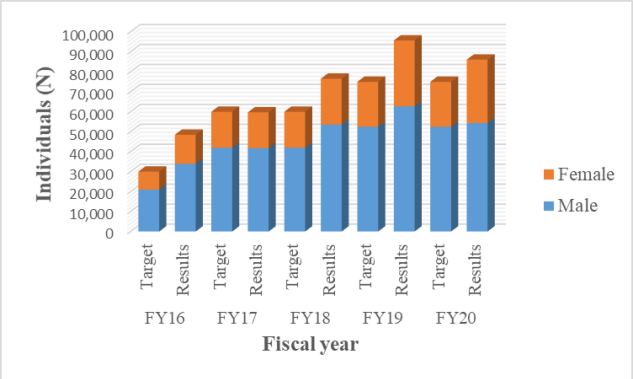

Fig. 28: Gender disaggregated beneficiaries (FY16-FY20)

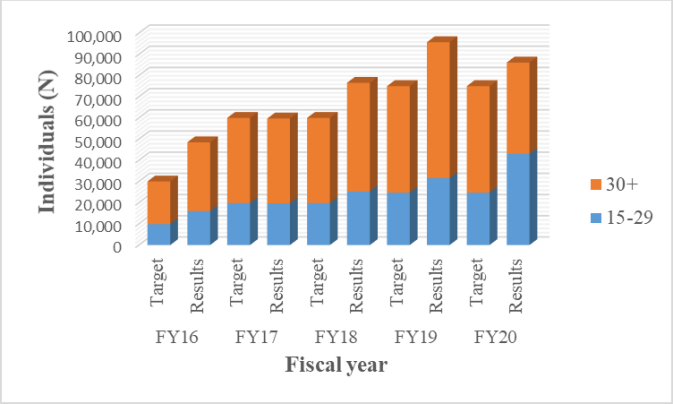

Fig 29: Age disaggregated beneficiaries (FY16-FY20)[5]

The approach used to facilitate access to improved technologies has proven successful and will sustain itself beyond the life of the project. Although the expected number of individuals who applied improved technologies was below the target in FY20 (Table 6), the results suggest that farmers applied the technologies on larger areas. The use of good quality seeds of improved varieties occupied 40% of the total area under technologies. Between FY16 and FY20 a total of 309,558 farmers applied improved technologies on 440,743 ha of land. These represent about 3% and 10% respectively, above the five-year targets for the number of individuals who applied improved technologies and the area under improved technologies.

Soybean and pigeon pea, which are important cash crops occupied 27 and 22%, respectively, of the total area under improved technologies followed by cowpea (17%) (Fig. 30). Sesame was planted on 12% of

[5] Youth disaggregation started in FY18. Data for FY16 and FY17 are based on realistic estimates.

the area, whereas common bean and groundnut each occupied 11% of the area under improved technologies.

Table 6: Technology application by the Fourth Quarter of FY 2020

Indicator	Disaggregation	Q4		Cumulative	
		Target	Results	Target	Results
Number of applicants (N)	Technology				
	Crop genetics	0	1,555	25,500	31,704
	Cultural practices	0	1,989	59,500	45,024
	Age				
	15-29	0	1,705	28,050	38,542
	30+	0	1,836	56,950	38,186
	Total	0	3,541	85,000	76,728
Area (ha)	Crop genetics	0	5,115	50,000	47,930
	Cultural practices	0	6,529	60,000	70,408
	Total	0	11,644	110,000	118,338

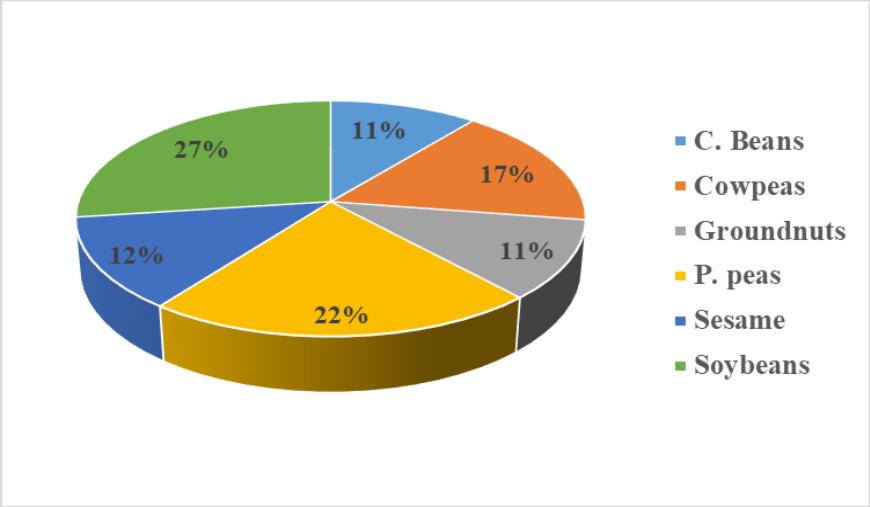

Fig. 30: Share area under improve technologies by crops (FY16-FY20)

Another sustainability indicator is farm level performance. Yields of the crops promoted by SEMEAR generally increased over the period, although harsh weather conditions especially in FY19 caused by Cyclone IDAI and Kenneth led to a sharp decline in yields, except for groundnut (Fig. 31). Common beans yield increased by 34% from the first year (FY16) to the last year of the project (1,058 to 1,416 kg/ha), groundnut increased by 36%, sesame by 18% and soybean by 20%. Cowpea yield increased by only 9%, whereas pigeon pea yield increased by 73%. Pests attack is a major challenge in cowpea production so at least one or two spraying regimes are necessary to increase yield, besides improved seed and better crop production practices. However, many farmers do not control pests attack on their fields, and this perhaps limited the observed yield improvement. For pigeon pea, the high yield increase was probably due to the relatively low yield in the first year (FY16) compared to that for the final project year. The project end-line study[6] indicated higher yield gains for sesame (42%), common bean (41%) and soybean (39%) compared to the baseline data among the broader population of the FTF ZOI but the data for groundnuts and pigeon were inconsistently low (Table 7).

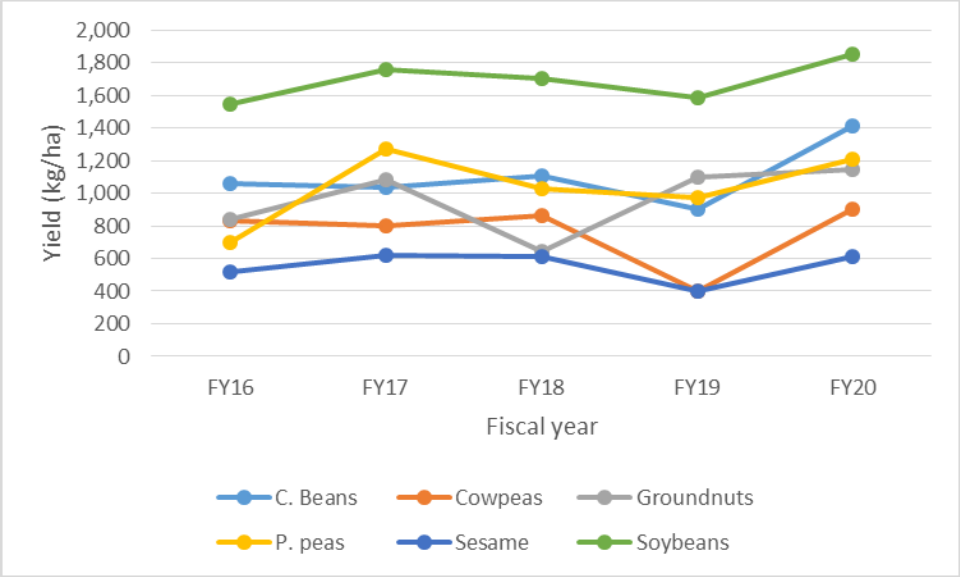

Fig. 31: Trend in yield of SEMEAR crops (FY16-FY20)

[6] Adoption of improved varieties and agricultural practices in Mozambique: Lessons from the implementation of the SEMEAR project. An End-line report to be submitted to USAID by SEMEAR project; 2020

Table 7: Baseline and end-line yield of SEMEAR crops

Crops	Baseline	End-line	% Change
Common bean	873	1227	41%
Cowpea	669	700	5%
Groundnuts	851	630	-26%
Pigeon pea	1060	1120	6%
Sesame	518	734	42%
Soybeans	1067	1488	39%

Further analysis shows that the technologies promoted by the project consistently led to positive gross margin per ha (Fig. 32). Cowpea, which is considered a food security crop with the lowest financial returns had gross margins ranging from $93 to US$376/ha, whereas common and soybean had margins that ranged from $220 to $940 and $295 to $714/ha, respectively. Common bean and soybean had the highest economic returns averaging $427 and $410/ha, respectively, from FY17 to FY20.

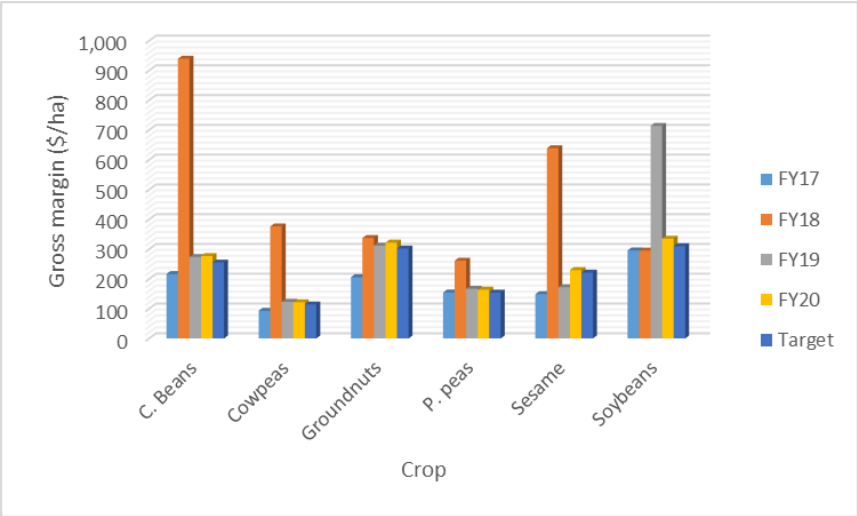

Fig. 32: Trend in gross margin ($/ha) for SEMEAR crops (FY16-FY20)

The project team again took advantage of the end-line study to specifically examine the income gains from the principal technology promoted, good quality seeds. Figure 33a compares farmers who use local seeds/varieties to those who use recycled seeds of improved varieties and good quality seeds of improved varieties. The results show that farmers who use recycled seeds of improved varieties obtain an additional income of $104.89/ha (i.e. $620.27-515.38). The second part of the figure show that when farmers use good quality seeds of improved varieties, they gain additional income of $481.25/ha.

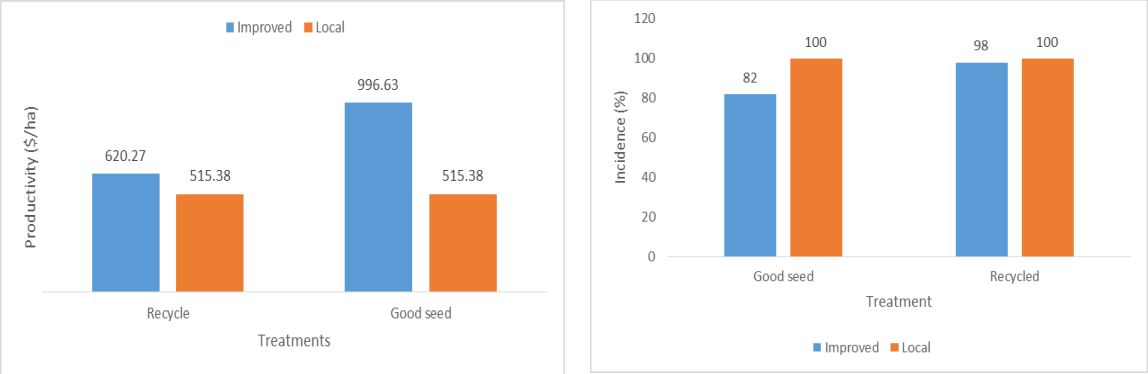

Fig 33: Impacts of quality seeds on farm income (a) and food insecurity (b)

Similarly, we compared the incidence of food insecurity among farmers who use local seeds to those who use good quality seeds and recycled seeds (Fig. 33b). The results show that 100% of farmers who use local seeds are food insecure. The use of recycled seeds reduces food insecurity by 2% while good quality seeds reduced food insecurity by 18%.

The results from the performance analysis and the end-line study show that SEMEAR has contributed significantly to the legume seed system in the FTF ZOI of Mozambique. The project has also increased access to these technologies which has significantly increase yields and farm income, and reduced food insecurity. We also observe that the project has provided a means of alternative livelihood for young people who would have otherwise migrated to the urban centers to look for jobs. This unintended impact is very interesting and must be sustained.

5. Major Implementation Issues

- Frequent drought was a major issue at many locations and affected crop development and yields
- The current COVID-19 pandemic limited human movements and interactions, and resulted in few training sessions, meetings and field days. Certified seed data collection was affected
- Cyclone IDAI which affected central Mozambique in March 2019 and cyclone Kenneth which affected northern Mozambique in April 2019 caused damage or completely destroyed fields. Cyclone Kenneth occurred when the crops were almost ready to be harvested and caused damage to fields in Nampula province due to excessive rainfall. This decreased the quality of seeds and resulted in reduced good quality seeds of cowpea and sesame
- Default on basic seed payment by partners mostly seed companies and the difficulty for SEMEAR collecting the debt since the project does not like to be engaged in legal actions

- Limited basic seed purchases by seed producers; hence SEMEAR had basic seed left over from year to year
- Delays on the part of SIU in providing Seed Certificates to community seed producers supported by SEMEAR prevented some seed producers to sell their seeds on time
- Inadequate human capital within the SIU is a major challenge. Only a fraction of the seed fields (about 16% excluding inspected fields of seed companies) are inspected every year by seed inspectors because of limited manpower. Thus, most seed fields were not inspected for seed certification.
- Delay in receiving project funds in FY20 until three months prior to the end of the project was a major bottleneck to the smooth implementation of the project activities.

6. Lessons Learned

- More farmers who produce cash crops such as soybean buy improve seeds compared to farmers who produce food security crops like cowpea. Thus, more farmer-saved seeds are planted for food security crops than cash crop.
- Partnerships with seed companies and community producers in seed production increased quantity of seeds in the farming communities, reduced the price of quality seeds, increased affordability and encouraged the use of quality seeds
- Availability of quality seed in farming communities has encouraged smallholder farmers to buy improved seeds
- Smallholder farmers have increased the quantity of seed purchases from local community-based seed producers over time as they have gradually developed trust in the quality of seed from local sources
- Engaging the private sector and community-based organizations facilitated information dissemination and scaled up project results
- On-farm demonstration on improved varieties and production practices managed by farmers is very essential in facilitating adoption and sustainable use of improved varieties and production practices as farmer learn by doing
- Sale of small packs of inputs by agro-dealers improved affordability and access to inputs
- Seed companies who were more dedicated and serious grew their seed business and are able to compete with international seed companies in the supply of seeds nationally

7. Collaboration with Other Donor Projects

SEMEAR collaborated with other projects including USAID funded projects to leverage on their investments, improve and scale up the dissemination of technologies and maximize the impacts of the interventions. Some of the notable collaboration established in the last five years include following:

- **Collaboration with APROSE**

The project collaborated with APROSE that has led to the migration of contents from SEMEAR website to the APROSE website: www.aprose.org and the link https://aprose.org/sobre-semear/# allowing for a wider access of technical information on EGS and complementary crop management practices. The project developed Seed Award Competition scheme with APROSE, which is expected to increase awareness of farmers on the importance of good quality seeds. The Seed Award discussions are led by APROSE and other participants including FTF INOVA, FAO, MADER under DNSA. The project has contributed more than US$ 9,500 for the implementation of the Seed Award Competition.

Collaboration with FTF INOVA

The project collaborated with FTF INOVA to link seed producers supported and trained by SEMEAR to INOVA's Market Systems to market certified seeds. Hélder Comercial, an Agrodealer based in Namiconha Administrative Post of Ribaué has successfully established a functional link with Olima Farms a seed producer based in Malema district. Hélder Comercial received consignment stocks from AgriFocus, Klein Karoo and other seed and input companies and he supplies vegetables and chemicals to Olima Farms. Olima Farms also sells certified seed locally produced through Hélder Comercial.

- **Collaboration with Solidaridad Southern Africa**

The collaboration with Solidaridad Southern Africa for the implementation of local seed multiplication activities in Angónia district of Tete was established in 2019. SEMEAR supplied of EGS Solidaridad beneficiary seed producers for multiplication into certified seeds.

- **Collaboration with iDE Moçambique**

The project collaborated with iDE Moçambique certified seed production in Tete province. The project trained and sold basic seed to seed producers identified by iDE to produce certified seed. Recently, the two project discussed ways of improving the use of improved technologies by farmers and how to increase their buying capacity through input fairs linked with the certified seed multiplication and digital information programs of iDE in Manica and Zambézia provinces.

- **Collaboration with FTF RAMA-BC**

SEMEAR collaborated with RAMA on establishing demonstration plots in Manica province. In the current reporting period, the two projects discussed the possibilities for them to partner in the development of a sustainable seed multiplication activity in Sofala province where RAMA is

implementing a resilient agriculture post-cyclone IDAI program. One seed grower was identified to produce 6 ha common bean certified seed.

- **Soybean Innovation Lab (SIL)**

The project collaborated with SIL and Syngenta Foundation on Pan African Soybean Variety Trials. This involved testing the adaptability of various soybean varieties (including those from Mozambique). This is on-going and was to assist SEMEAR to compare local varieties with other available varieties on the continent to identify high yielding varieties that could be registered and released in Mozambique. Phoenix Seeds, a partner of SEMEAR was invited to participate in the testing and identification of soybean varieties which can potentially be released and commercialized by Phoenix Seed.

- **University of Illinois**

In this collaboration, the parties developed and implemented an extension service capacity development program that focused on Integrated Pest Management (IPM) practices. The training program focused on the development of the capacities of national Extension Agents and was led by a PhD student. The first working visit was held in November 2018 and the first training was held from 27 August to 12 September 2019 in Nampula, Gurué and Angónia; 101 extension agents (17 women) from SDAEs and other project or seed companies' technicians were trained.

- **SUSTENTA**

SUSTENTA is a sustainable Value Chain Development Project funded by the World Bank and recently expanded to cover all the provinces in Mozambique (2018 – 2028). The project is implemented by the Ministry of Agriculture and Rural Development (MADER). SUSTETA aims at promoting integrated rural and value development for improved livelihoods of rural households in Mozambique. In the previous phase the project supplied basic seeds of common bean, sesame and soybean to SUSTEANTA seed producers in Alto Molocué, Gurué, Mocuba, Ile and Gilé districts of Zambézia, trained the seed producers and supported the inspection and certification of their seed fields. SUSTENTA would support seed growers to mature to Emerging Commercial Farmers (PACE – *Pequeno Agricultor Comercial Emergente*). A "PACE" is "hub farmer" who has 200 other farmers to assist with inputs and extension advisory. SEMEAR viewed this partnership as strategic in the sense that locally produced seeds could be disseminated in the communities to increase affordability and sustainability of the interventions.

8. Key Activities Planned for FY 21 (SEMEAR Extension First Quarter)

Key activities for FY20: SEMEAR will focus activities to consolidate the achievement over the last five year during FY21 for sustainability of the project results. The activities will place emphasis on capacity development and Market System Development involving private sector engagement. These include:

- Produce and supply EGS to seed companies and community seed producers;

- Organize technical training workshop for IIAM and IITA staff on appropriate planning, management and production of EGS and timely coordination with seed companies and other seed producers on their EGS requirements;
- Identify and train private seed companies and seed enterprises that are interested in basic seed production and link them to IIAM breeders for continuous supply of breeder and pre-basic seed;
- Establish observation plots for Distinctness, Uniformity and Stability (DUS) in partnership with the National Seed Authority (ANS) to train and collect DUS data
- Develop the capacities of existing enterprising community seed producers to understand market preferences of various crops, varietal traits and adaptation zones, best management practices, business development, marketing and joining out grower schemes to sell their seed
- Focus on supporting market-oriented demo plots for seed producers to popularize the varieties they grow in the communities to increase sales within the communities and attract relatively bigger Seed Companies and Input dealers to source seeds;
- Link seed producers to use INOVA's market system development scheme to facilitate the sale of their seeds and to access inputs;
- Rehabilitate irrigation facilities at IIAM Research Station at Ribaué and Ntengo Umodzi in coordination with other USAID Initiatives to support EGS production during off-season and under drought conditions.

Main Activities for Next Quarter

- Identify fields for EG seed production
- Land preparation for seed multiplication
- Seed sales and distribution
- Harvest off-season cowpea and soybean pre-basic seed fields
- Organize and conduct training workshop on planning, management and production of EGS
- Engage, identify and train seed companies interested in producing basic seeds
- Train seed producers on seed production and strategies for sustainable community seed schemes
- Identify seed companies and community seed producers to establish joint demo plots
- Conduct trainings for Lead Farmers and Extension Agents to host demos
- Broadcast radio programs to inform seed companies and farmers the availability of early generation and certified seeds
- Identify a contractor to conduct rehabilitation work on IIAM irrigation facilities

9. Evaluation/Assessment Update

Evaluations, Assessments, Studies, and Audits Include any and all types of evaluations, financial or programmatic, internal or external.	
Completed: List evaluations, assessments, studies and/or audits held last year	Major Findings/Recommendations
All studies are ongoing	
Planned: List evaluations, assessments, studies, and/or audits planned for next two quarters.	
1. Adoption of improved varieties and agricultural practices in Mozambique: Lessons from the implementation of the SEMEAR project. It is being finalized	

10. Administrative Update

There are no administrative updates or major procurement issues at the moment that need the attention of the COR/AOR.

11. Financial Information

Table 8 – Estimated SEMEAR expenditures from 1 October 2019 to 30 September 2020.

Order	Cost Item	Description	US$
1	Office cost, supplies	Include: security, rents, suppliers (electricity, water) stationary, and others	146,946
2	Field activities and suppliers	Include: land preparations, chemicals, materials, field day supplies, etc.)	34,198
3	Travels	Include: allowances (Per diem and accommodation) and tickets	135,071
4	Training and workshops	Include: farmer training, field days, project planning and review meetings, etc.	35,506
5	Personnel	Staff salaries, casual staff wages, taxes, and allowances	428,952
6	Consultancy Services	Include: hiring of enumerators and other consultants	155,307
7	Other direct costs	Including communications and minor purchases	290,800
Sub-Total			**1,088,709**
Overhead (18.61%)			202,608.74
Grand Total			**1,291,317.74**

12. Success Story

The Dreamers Group scaling seeds of success

Members of the Dreamers Group in Zambezia Province, Northern Mozambique, were smiling all the way to the bank in the just-ended farming season (2019/2020) as they generated more than 2,277,000 MZN (≈ US$31,625) from the production and sale of soybean and common bean seed, grain and vegetables. The group, known as DG or Dreamers, identified seed production as a very lucrative business. With support from the Feed the Future Mozambique Improved Seeds for Better Agriculture project (SEMEAR) funded by USAID, they are now running a very successful venture on the production and commercialization of soybean and common bean certified seed.

The group ventured into the seed production business in the 2017/2018 cropping season by acquiring a farm in Murrimo, a community in Gurué District, Zambezia Province, to start seed production. SEMEAR trained the group on seed production and sold to them basic seeds of soybean and common bean to start them off in the production of certified seed. They started with 10 ha; 7 ha for soybean and 3 ha for common bean certified seed and harvested 8.7 tons of soybean and 2.4 tons of common bean seed. These corresponded to 1.25 t/ha for soybean and 0.8 t/ha for common bean. SEMEAR also supported DG to establish demonstration fields /farmer field school (FFS) where neighbouring farmers learn best crop management practices, source quality seeds, and access affordable mechanization services to improve production and productivity to ensure food and nutrition security and generate income.

In the second year (2018/2019), the group extended their seed production activity by engaging five outgrowers selected from well-skilled and knowledgeable farmers to produce soybean and common bean certified seeds with technical support from DG and the SEMEAR project. DG also provides mechanization services to their seed outgrowers

“It was a very good year, we managed to reach yields of 1.5 t/ha for soybean and 1 t/ha for common bean, under our conditions. If farmers can get these results, we can succeed in developing the agriculture sector”, said Anacleto Saint Mart, DG Leader.

In the following year, 2019/2020, DG expanded their seed production area to 20 ha and the outgrowers planted 5 ha each for soybean and common bean certified seed Again, they harvested 15 tons soybean and 10 tons common bean certified seed at the same yields of 1.5 t/ha for soybean and 1 t/ha for common bean. Apart from selling certified seed to seed companies and other farmers, the group also generates

income from growing soybean grain, yellow maize, and vegetables such as onions, cabbage, and green pepper on another parcel of land. The group acquired four tractors with implements through a loan from the Government's Agricultural Development Fund (FDA) in 2017 and so they provide mechanization services at cost to other farmers in the communities.

The Dreamers Group was formed on 16 September 2016 by 10 young men with expertise in agriculture, community development, and environment sustainability. They are led by Anacleto Saint Mart, an agronomist who benefitted from a USAID scholarship for his Bachelor and master's degrees outside Mozambique. Part of the profit generated by DG from the sale of seeds, grain and vegetable in the 2019/2020 season was used to support the group and their members to acquire additional land, pay wages, and complete a warehouse construction at Murrimo with the capacity to store about 50 tons of seeds. The group dreams of transforming the DG farm into a skills training centre to improve knowledge and expose farmers to new technologies. "We at DG dream to become a center of knowledge where farmers will learn and share their experiences to improve productivity and production. We are satisfied with the current yields we are obtaining on our farms and the outgrowers' fields," said Anacleto Saint Mart.

An overview of the DG's farm

Lourindo Jacinto Abel, the DG farm manager at the soybean farm

Ripping the farm for planting to ensure minimum soil disturbance as part of Conservation Agriculture